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NASA/SP—1999–7037/SUPPL410
December 1999

AERONAUTICAL ENGINEERING

A CONTINUING BIBLIOGRAPHY WITH INDEXES

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Typical Report Citation and Abstract

❶ 19970001126 NASA Langley Research Center, Hampton, VA USA

❷ Water Tunnel Flow Visualization Study Through Poststall of 12 Novel Planform Shapes

❸ Gatlin, Gregory M., NASA Langley Research Center, USA Neuhart, Dan H., Lockheed Engineering and Sciences Co., USA; Mar. 1996; 130p; In English

Contract(s)/Grant(s): RTOP 505-68-70-04

❹ Report No(s): NASA-TM-4663; NAS 1.15:4663; L-17418; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

❼ To determine the flow field characteristics of 12 planform geometries, a flow visualization investigation was conducted in the Langley 16- by 24-Inch Water Tunnel. Concepts studied included flat plate representations of diamond wings, twin bodies, double wings, cutout wing configurations, and serrated forebodies. The off-surface flow patterns were identified by injecting colored dyes from the model surface into the free-stream flow. These dyes generally were injected so that the localized vortical flow patterns were visualized. Photographs were obtained for angles of attack ranging from 10° to 50°, and all investigations were conducted at a test section speed of 0.25 ft per sec. Results from the investigation indicate that the formation of strong vortices on highly swept forebodies can improve poststall lift characteristics; however, the asymmetric bursting of these vortices could produce substantial control problems. A wing cutout was found to significantly alter the position of the forebody vortex on the wing by shifting the vortex inboard. Serrated forebodies were found to effectively generate multiple vortices over the configuration. Vortices from 65° swept forebody serrations tended to roll together, while vortices from 40° swept serrations were more effective in generating additional lift caused by their more independent nature.

❽ Author

❾ *Water Tunnel Tests; Flow Visualization; Flow Distribution; Free Flow; Planforms; Wing Profiles; Aerodynamic Configurations*

Key

1. Document ID Number; Corporate Source
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AERONAUTICAL ENGINEERING

A Continuing Bibliography (Suppl. 410)

DECEMBER 1999

01
AERONAUTICS

19990107410 Federal Aviation Administration, Washington, DC USA
Aeronautical Information Publication, USA of America, Fifteenth Edition
Jan. 28, 1999; 642p; In English
Report No.(s): PB99-124372; No Copyright; Avail: CASI; A99, Hardcopy; A06, Microfiche

Topics discussed include the following: National Regulations and Requirements; Tables and Codes; Services; and Charges for Aerodromes/Heliports and Air Navigation Services.

NTIS

Air Navigation; Airports; Regulations; Air Transportation; Heliports; Aircraft Landing

19990111540 Nebraska Univ., Aviation Inst., Omaha, NE USA
Journal of Air Transportation World Wide, Volume 4
Bowen, Brent D., Editor, Nebraska Univ., USA; Kabashkin, Igor, Editor, Riga Aviation Univ., Latvia; 1999; ISSN 1093-8826; 172p; In English; See also 19990111541 through 19990111548; Copyright; Avail: Issuing Activity, Hardcopy

The Journal of Air Transportation World Wide's (JATWW) mission is to provide the global community immediate key resource information in all areas of air transportation. The goal of the Journal is to be recognized as the preeminent scholarly journal in the aeronautical aspects of transportation. As an international and interdisciplinary journal, the JATWW will provide a forum for peer-reviewed articles in all areas of aviation and space transportation research, policy, theory, case study, practice, and issues. While maintaining a broad scope, a focal point of the journal will be in the area of aviation administration and policy.

Derived from text

Air Transportation; Space Transportation

19990116746 Royal Aeronautical Society, London, UK
Missile Aerodynamics; Proceedings
Missile Aerodnamics; 1999; 110p; In English, 23 Sep. 1999, London, UK; See also 19990116747 through 19990116753; ISBN 1-85768-151-7; Copyright; Avail: Issuing Activity, Hardcopy

This paper presents Conference Proceedings on Missile Aerodynamics. Topics include: 1) Keynote Address; 2) Aerodynamics of Non-Axisymmetric Missile Airframe; 3) Selected Control and Steering Issues for Non-Axisymmetric Missiles; 4) A review of Lattice Control Research in the UK; 5) Aerodynamic Development of a Multiple Rail Missile Launcher for High Speed Aircraft; 6) The loads on a Missile at Launch from an Internal Weapons Bay; 7) Interaction of Missile Propulsion and Aerodynamics; 8) Unsteady Aerodynamics of Slender Bodies; 9) Hypersonic Missiles- Some Problem Areas; and 10) Aerodynamic Aspects of the Starstreak Missile System.

CASI

Aerodynamic Characteristics; Conferences; Jet Propulsion; Missile Systems; Hypersonic Aircraft

19990116760 Westland Helicopters Ltd., Advanced Engineering Dept., Yeovil, UK
A Review of European Research Initiatives
Ingram, David, Westland Helicopters Ltd., UK; The Potential of Rotocraft to Increase Airport Capacity: Proceedings; 1999, pp. 8.1 - 8.24; In English; See also 19990116754; Copyright; Avail: Issuing Activity, Hardcopy

This paper presents viewgraphs of A Review of European Research Initiatives. Topics include: 1) Introduction; 2) Aims; 3) Scope; 4) Elements of the System; 5) Air Infrastructure Studies; 6) Airport/4; 7) Respect; 8) Ground Movement Studies; 9) Air

Vehicle; 10) Airborne Air Traffic Management (ATM) Research Activities; 11) Quiet Helicopter Technology Research Areas; 12) European Tilt-Rotor; 13) Sourdine; 14) Helicopter Operational Noise Abatement (Honab); 15) Passengers/Public; 16) Eurosil; 17) Castore; 18) Railair; 19) Summary; 20) Where Next? 21) Project ICARUS; and 22) The Way Forward. The report includes summaries of the topics above.
CASI
Tilt Rotor Aircraft; Air Traffic Control; Airports; Helicopter Performance; Aircraft Noise

02
AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

19990110582 NASA Dryden Flight Research Center, Edwards, CA USA
Adaptive Wing Camber Optimization: A Periodic Perturbation Approach
Espana, Martin, NASA Dryden Flight Research Center, USA; Gilyard, Glenn, NASA Dryden Flight Research Center, USA; Automatic Control in Aerospace; September 1994, pp. 35-40; In English; Aerospace Control, 12-16 Sep. 1994, Palo Alto, CA, USA; Sponsored by International Federation of Automatic Control
Report No.(s): H-1998; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Available redundancy among aircraft control surfaces allows for effective wing camber modifications. As shown in the past, this fact can be used to improve aircraft performance. to date, however, algorithm developments for in-flight camber optimization have been limited. This paper presents a perturbational approach for cruise optimization through in-flight camber adaptation. The method uses, as a performance index, an indirect measurement of the instantaneous net thrust. As such, the actual performance improvement comes from the integrated effects of airframe and engine. The algorithm, whose design and robustness properties are discussed, is demonstrated on the NASA Dryden B-720 flight simulator.
Author
Adaptive Control; Optimization; Wing Camber; Perturbation; Drag; Control Surfaces; Flight Simulators; Transport Aircraft

19990111784 Arizona State Univ., Dept. of Mechanical and Aerospace Engineering, Tempe, AZ USA
Swept-Wing Receptivity Studies Using Distributed Roughness *Final Report, 1 Jun. 1997 - 31 Oct. 1999*
Saric, William S., Arizona State Univ., USA; October 1999; 15p; In English
Contract(s)/Grant(s): NAG1-1925; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Transition to turbulence in swept-wing flows has resisted correlation with linear theory because of its sensitivity to freestream conditions and 3-D roughness and because one of the principal instability modes quickly 'becomes nonlinear. In the face of such a formidable problem, two rather long-term fundamental efforts have been underway at DLR Gottinberg and Arizona State University that address swept-wing transition. These efforts have been recently reviewed by Bippes (1997) and Reibert and Saric (1997). Thus, the present work is a continuation of a series of studies on swept-wing boundary layers which have led to a better understanding of the transition process. In particular, we have taken advantage of the sensitivity to 3-D roughness and the modal nature of the instability in order to propose a particular control strategy. Complementing the two aforementioned reviews, general reviews of the swept-wing transition problem are found in Arnal (1997) and Kachanov (1996). Other recent reviews include Reshotko (1997), Crouch (1997), and Herbert (1997a,b). The failure of linear theory is discussed in Reed et al. (1996). The historical work is found in Reed and Sar-ic (1989). The basic idea is that the combination of sweep and chordwise pressure gradient within the boundary layer creates a velocity component perpendicular to the inviscid streamline. This crossflow profile is inflectional and exhibits both traveling and stationary unstable waves called crossflow vortices that are (approximately) aligned along the inviscid streamlines. Under conditions of low freestream turbulence levels, the dominant crossflow wave is stationary (Reibert and Saric 1997) while moderate to high turbulence levels initiate dominant traveling waves (Dehle and Bippes 1996; Bippes 1997). 'Me mechanism is relatively insensitive to sound and 2-D surface roughness (Radeztsky et al. 1993) but very sensitive to 3-D roughness near the attachment line. We concentrate our work on low-turbulence freestream flows and stationary crossflow waves. Although the v' and w' components of the disturbances are very small, by convecting streamwise momentum in the wall-normal direction, they produce 0(1) changes inu'.Thus the mean flow is highly distorted with localized inflection points. Transition is then triggered by a high-frequency secondary instability of the distorted mean profile.
Author
Vortices; Turbulence; Traveling Waves; Surface Roughness; Low Turbulence; Inviscid Flow; Boundary Layers

19990114895 Naval Air Warfare Center, Aircraft Div., Patuxent River, MD USA

Concepts for Lift Improvements of a High-Lift Military Airfoil

Hall, D. R.; Dodbele, S. S.; Jul. 01, 1999; 11p; In English

Report No.(s): AD-A367707; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper describes the computational analysis of several concepts to improve the maximum lift of a military high-lift airfoil configuration. The computational results are compared with the wind-tunnel data obtained for a gap and overhang study and a Gurney flap study. In the wind tunnel experiments, optimizing the gap and over-hang and adding a Gurney flap provided the largest increases, on the order of 3-4%. These trends were duplicated in the CFD analyses. Incremental lift improvements were found using the Gurney flap and by adjusting the gap and overhand of the flap. Life improvement was also obtained by perturbing the leading edge portion of the trailing edge flap. It was found that the lift enhancements were additive, the maximum lift increased by 14% using a Gurney flap and the flap at the optimum gap and overlap. The CFD analyses used an unstructured Navier-Stokes code. The wind tunnel tests were a cooperative effort between the Navy, Boeing (St. Louis), and NASA Langley Research Center (LaRC) and were conducted in the NASA LaRC Low Turbulence Pressure Tunnel. Forces and moments and other parameters were measured on a two-dimensional airfoil model of an advanced fighter win section configured with a deflected leading edge flap, shroud and a slotted trailing edge flap.

DTIC

Computational Fluid Dynamics; Navier-Stokes Equation; Wind Tunnel Tests; Airfoils; Lift; Aerodynamic Configurations

19990116018 Massachusetts Inst. of Tech., Lincoln Lab., Lexington, MA USA

Aircraft Vortex Spacing System (AVOSS) Initial 1997 System Deployment at Dallas/Ft. Worth (DFW) Airport

Dasey, T. J.; Cole, R. E.; Heinrichs, R. M.; Matthews, M. P.; Perras, G. H.; Jul. 08, 1998; 92p; In English

Report No.(s): PB99-175598; L-3; NASA/A-1; Copyright Waived; Avail: CASI; A01, Microfiche; A05, Hardcopy

The potential hazard of aircraft encounters with the wake turbulence of preceding aircraft requires the use of minimum separations on landing that are significant constraint on airport arrival capacity during instrument flight rules (IFR) conditions. The National Aeronautics and Space Administration (NASA) Langley research Center has been researching the development of the Aircraft Vortex Spacing System (AVOSS) which would dynamically change aircraft arrival separations based on the forecasted weather conditions and vortex behavior.

NTIS

Vortices; Deployment; Aircraft Approach Spacing

19990116252 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA

Wind Tunnel Investigation of Joined Wing Configurations *Final Report, Sep. 1998 - Jun. 1999*

Corneille, Jennifer; Jun. 15, 1999; 125p; In English

Report No.(s): AD-A364823; AFIT/GAE/ENY/99J-02; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The Air Force Research Laboratory's Munitions Directorate is looking to extend the range of its small smart bomb. One proposed idea is to retrofit the bombs with a wing kit, particularly a joined wing configuration. A typical joined wing configuration is one where the wings are positioned in such a way that they form a diamond in both plan and front views. The purpose of this study is to conduct low speed wind tunnel testing of the joined wing configuration to help determine if the joined wing is more beneficial than a single wing configuration. Configurations with differing sweep angles and tip interconnects will be tested in the AFIT 5' wind tunnel. The lift, drag, and pitching moment coefficients will be ascertained. All researched literature indicates that certain joined wing configurations outperform its single wing counterpart.

DTIC

Wind Tunnel Tests; Joined Wings; Aerodynamic Coefficients; Body-Wing Configurations

19990116373 California Univ., Los Angeles, CA USA

Renaissance of Aeroelasticity and Its Future

Friedmann, Peretz P., California Univ., USA; Journal of Aircraft; Feb. 1999; Volume 36, No. 1, pp. 105-121; In English; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): NCC2-379; DAAH04-95; Copyright; Avail: Issuing Activity, Hardcopy

The primary objective of this paper is to demonstrate that the field of aeroelasticity continues to play a critical role in the design of modern aerospace vehicles, and several important problems are still far from being well understood. Furthermore, the emergence of new technologies, such as the use of adaptive materials (sometimes denoted as smart structures technology),

providing new actuator and sensor capabilities, has invigorated aeroelasticity, and generated a host of new and challenging research topics that can have a major impact on the design of a new generation of aerospace vehicles.
Derived from text

Aeroelasticity; Smart Structures; Structural Engineering; Aeronautical Engineering; Aircraft Structures; Transonic Speed; Transonic Flutter; Navier-Stokes Equation; Computational Fluid Dynamics; Rotary Wings

19990116463 Naval Air Warfare Center, Aircraft Div., Patuxent River, MD USA

Experimental Investigation of Vortex-Tail Interaction on a 76/40 Degree Double-Delta Wing

Ghee, Terence A.; Gonzalez, Hugo A.; Findlay, David B.; Apr. 22, 1999; 19p; In English

Report No.(s): AD-A368657; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An experimental investigation was conducted to quantify the vortex-tail interaction on a 76/40 degree double delta wing model. The effects of different fillets at the wing/strake juncture, tail span wise positions, and angles of attack were evaluated. The vertical tails were instrumented with 28 fast response pressure transducers. Pressure time histories and frequency power spectral densities were analyzed for 35 configurations. Angle of attack was varied from -2 to 40 degrees, tunnel dynamic pressure was 26.74 psf and Reynolds number was 1.3 million. The results show a strong dependence on fillet geometry, tail position, transducer measurement location, and angle of attack on the magnitude and frequency of the tail response to the vortex forcing. In addition, a low frequency pulse was found that contained tremendous energy.
DTIC

Vortices; Delta Wings; Tail Assemblies; Stabilizers (Fluid Dynamics); Fillets; Interactional Aerodynamics; Aircraft Models; Aerodynamic Configurations

19990116484 Army Research Lab., Human Research and Engineering Directorate, Aberdeen Proving Ground, MD USA

Evaluation of Obturator and Sealing Cuff Properties for the M865 Training Projectile with Comparison to Ballistic Testing *Final Report, Jan 1997-May 1999*

Hoppel, C. P.; Newill, J. F.; Soencksen, K. P.; Sep. 1999; 51p; In English

Report No.(s): AD-A368869; ARL-TR-2039; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The nylon obturation and RTV sealing cuff for the M865 training round were evaluated to identify potential sources of ballistic variability associated with the material properties and material processing. While the properties of these materials are strongly dependent on processing conditions, temperature, and moisture content, the M865 performance variability is reduced by a well-engineered fracture mechanism that focuses the stresses in the obturation during sabot discard. A ballistic test was developed to validate the study. For the ballistic test, obturators were manufactured in "brittle," "tough," and "tough-wet" conditions. These three conditions produced significant differences in the mechanical properties (the maximum strength varied by a factor of 2, the elastic modulus varied by a factor of 25, and the elongation to failure varied by a factor of 10). However, the ballistic performance did not show any significant variability due to the obturation properties.
DTIC

Mechanical Properties; Performance Tests; Kinetic Energy; Ballistics

19990116682 Instituto Nacional de Tecnica Aeroespacial, Area de Documentacion Cientificia Biblioteca, Torrejon de Ardoz, Spain

Theory of control application to aerodynamic design. Theoretical development *Aplicacion de la teoria de control al diseno aerodinamico. Desarrollo teorico*

Monge-Gomez, Fernando, Instituto Nacional de Tecnica Aeroespacial, Spain; Tobio-Rios, Berta, Instituto Nacional de Tecnica Aeroespacial, Spain; Jun. 16, 1997; 31p; In Spanish

Report No.(s): AT/TNO/4510/008/INTA/97; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In numerical optimization, one of the most computationally demanding tasks, when one uses the traditional approach to estimate the gradients of the objective function using finite difference approximations, is determining the search direction. The number of necessary aerodynamic analysis, and therefore the computing time, is proportional to the number of design variables used to define the deformations of the geometry, as we have demonstrated in recent publications. An alternative for reducing the computer time substantially consists in applying optimal control theory (calculus of variations), which leads to the formulation of two separate problems: on the one hand, one has to solve for the fluid flow over a given geometry, and on the other hand, one has to solve the so-called adjoint problem, which is formulated so that no fluid variables appear in the gradient of the objective function, thereby simplifying considerably the calculations of the search direction. Normally the adjoint problem is of the same

type as that of the flow analysis, which means that the computing time will not be excessively penalized even if the number of design variables is high.
Author
Aerodynamic Characteristics; Design Analysis; Numerical Analysis; Control Theory; Simplification

19990116749 Aircraft Research Association Ltd., Bedford, UK
Aerodynamic Development of a Multiple Rail Missile Launcher for High Speed Aircraft
Childs, M. A., Aircraft Research Association Ltd., UK; Corby, N., Aircraft Research Association Ltd., UK; Eaton, C. J., Alenia Marconi Systems Ltd., UK; Newby, B. J., Alenia Marconi Systems Ltd., UK; Missile Aerodynamics: Proceedings; 1999, pp. 4.1 - 4.15; In English; See also 19990116746; Copyright; Avail: Issuing Activity, Hardcopy

The paper reviews aerodynamic aspects of the work already completed and future plans in the development of a multiple rail launcher for high-speed aircraft as part of the Brimstone air launched anti-armour system. The work is not yet complete as first firings have not taken place. However wind tunnel and Computational Fluid Dynamics (CFD) studies have optimised the preliminary level launcher configuration to both reduce the drag and centre of gravity migration during missile release. Aircraft integration testing is well advanced with two of the required aircraft grid survey and carriage load test series concluded and the first jettison releases successfully completed.
Derived from text
Wind Tunnel Tests; Computational Fluid Dynamics; Air Launching; Supersonic Flight; Structural Design; Missile Launchers

19990116753 Shorts Missile Systems Ltd., Belfast, UK
Aerodynamic Aspects of the Starstreak Missile System
Mallon, P. C. G., Shorts Missile Systems Ltd., UK; McIlwain, S. T., Shorts Missile Systems Ltd., UK; Missile Aerodynamics: Proceedings; 1999, pp. 9.1 - 9.10; In English; See also 19990116746; Copyright; Avail: Issuing Activity, Hardcopy

Starstreak is a very short range air defence system (VSHOKADS) for defence against helicopters, high speed ground attack aircraft and other aerial and ground targets. The system has been developed and produced by Shorts Missile Systems Ltd of Belfast, Northern Ireland. The missile is available as a self propelled version on a Stormer chassis, lightweight multiple launcher and shoulder launch version, and is currently being evaluated for use on the Apache Attack Helicopter. The missile, which employs a laser beam guidance system, consists of a two-stage solid propellant rocket motor, a separation system and three high density canard configuration submunitions, or darts. The three darts, which have no propulsive system, separate from the boost vehicle when the missile achieves maximum velocity, and are then independently guided to the target. This paper presents an overview of the main aerodynamic aspects of the system including propulsion/aerodynamic interactions during boost, multiple body aerodynamic interactions at supersonic speeds and roll control of the darts as they decelerate from high supersonic to transonic Mach numbers. Each of these aspects has been the subject of a detailed theoretical and experimental investigation to solve the associated problems.
Author
Air Defense; Missile Systems; Solid Propellant Rocket Engines; Supersonic Speed; Wind Tunnel Tests; Aerodynamic Configurations; Attack Aircraft

19990116797 Naval Air Warfare Center, Aircraft Div., Patuxent River, MD USA
Turning Down Wind? Don't Lose the Axis!
Kolwey, Herman G.; Jul. 19, 1999; 18p; In English
Report No.(s): AD-A368602; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Discussions have continued in the aviation press over the past 24 years between pilots as to whether or not there is a thing called the "Downwind Turn Phenomenon." Opponents to the theory (principally airline pilots) say, "If you fly Needle, Ball, and Airspeed, you will never get yourself in trouble!" They are, of course, right - IF the aircraft is flown in this manner. Proponents say that no, "When I fly my crop-duster to a visual ground reference it IS different turning downwind than when turning into the wind!" Every article of the opponents elicits about six letters to the editor from crop-duster pilots restating their position and beliefs. The logic of their arguments has not convinced a single one of the airline pilots. Truth of the matter, though, is that the crop-duster pilots are also RIGHT. This is an emotionally charged issue for the pilots on both sides (e.g., How dare you tell me how I fly my aircraft!!!). In the meantime, we continue to wreck aircraft, which is why I continue to try and explain this problem.
DTIC
Pilots; Aeronautics; Airline Operations; Airspeed

19990116900 Defence Science and Technology Organisation, Air Operations Div., Melbourne Australia

WTSETUP: Software for Creating and Editing Configuration Files in the Low Speed Wind Tunnel Data Acquisition System

Edwards, Craig D.; Aug. 1999; 37p; In English

Report No.(s): AD-A369587; DSTO-TN-0217; DODA-AR-011-055; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

The Data Acquisition System in the Low Speed Wind Tunnel at the Aeronautical and Maritime Research Laboratory is responsible for the measurement, recording, processing and displaying of wind tunnel test data. The system requires a number of initialization files which define the test programme, model configuration, hardware setup and data reduction processes. These text files often need to be changed by the operator when setting up a new test and sometimes at regular stages during the test programme. Software titled WTSETUP has been developed which allows the operator to create and/or edit wind tunnel configuration files via a user friendly, windows-based interface. The interface consists of a collection of menus, text boxes and switches, which allow the user to modify file parameters easily and avoid the chance of format errors. WTSETUP provides a simple and safe means of creating and/or modifying configuration files, and it has led to a large increase in wind tunnel productivity.

DTIC

Data Acquisition; Software Engineering; Wind Tunnel Tests; Editing; Configuration Management

19990117251 NASA Langley Research Center, Hampton,VA USA

Aerodynamic Characteristics and Control Effectiveness of the HL-20 Lifting Body Configuration at Mach 10 in Air

Scallion, William I., NASA Langley Research Center, USA; September 1999; 59p; In English

Contract(s)/Grant(s): RTOP 242-80-01-01

Report No.(s): NASA/TM-1999-209357; L-17867; NAS 1.15:209357; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

A 0.0196-scale model of the HL-20 lifting-body, one of several configurations proposed for future crewed spacecraft, was tested in the Langley 31-Inch Mach 10 Tunnel. The purpose of the tests was to determine the effectiveness of fin-mounted elevons, a lower surface flush-mounted body flap, and a flush-mounted yaw controller at hypersonic speeds. The nominal angle-of-attack range, representative of hypersonic entry, was 2 deg to 41 deg, the sideslip angles were 0 deg, 2 deg, and -2 deg, and the test Reynolds number was 1.06 x 10 E6 based on model reference length. The aerodynamic, longitudinal, and lateral control effectiveness along with surface oil flow visualizations are presented and discussed. The configuration was longitudinally and laterally stable at the nominal center of gravity. The primary longitudinal control, the fin-mounted elevons, could not trim the model to the desired entry angle of attack of 30 deg. The lower surface body flaps were effective for roll control and the associated adverse yawing moment was eliminated by skewing the body flap hinge lines. A yaw controller, flush-mounted on the lower surface, was also effective, and the associated small rolling moment was favorable.

Author

Aerodynamic Characteristics; Controllability; Effectiveness; Lifting Bodies; Scale Models; Wind Tunnel Tests; Elevons; Fins

19990117252 NASA Langley Research Center, Hampton, VA USA

Unstructured Grid Viscous Flow Simulation Over High-Speed Research Technology Concept Airplane at High-Lift Conditions

Ghaffari, Farhad, NASA Langley Research Center, USA; November 1999; 32p; In English

Contract(s)/Grant(s): RTOP 537-07-51-02

Report No.(s): NASA/TP-1999-209718; NAS 1.60:209718; L-17865; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Numerical viscous solutions based on an unstructured grid methodology are presented for a candidate high-speed civil transport configuration, designated as the Technology Concept Airplane (TCA), within the High-Speed Research (HSR) program. The numerical results are obtained on a representative TCA high-lift configuration that consisted of the fuselage and the wing, with deflected full-span leading-edge and trailing-edge flaps. Typical on-and off-surface flow structures, computed at high-lift conditions appropriate for the takeoff and landing, indicated features that are generally plausible. Reasonable surface pressure correlations between the numerical results and the experimental data are obtained at free-stream Mach number (Msub infinity) = 0.25 and Reynolds number based on bar-c R(sub c) = 8 x 10(exp 6) for moderate angles of attack of 9.7 deg. and 13.5 deg. However, above and below this angle-of-attack range, the correlation between computed and measured pressure distributions starts to deteriorate over the examined angle-of-attack range. The predicted longitudinal aerodynamic characteristics are shown

to correlate very well with existing experimental data across the examined angle-of-attack range. An excellent agreement is also obtained between the predicted lift-to-drag ratio and the experimental data over the examined range of flow conditions.
Author
Viscous Flow; Systems Simulation; Aerodynamic Characteristics; High Speed; Unstructured Grids (Mathematics)

03
AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

19990107328 NASA Langley Research Center, Hampton, VA USA
Flight Data Reduction of Wake Velocity Measurements Using an Instrumented OV-10 Airplane
Vicroy, Dan D., NASA Langley Research Center, USA; Stuever, Robert A., NASA Langley Research Center, USA; Stewart, Eric C., NASA Langley Research Center, USA; Rivers, Robert A., NASA Langley Research Center, USA; September 1999; 66p; In English
Contract(s)/Grant(s): RTOP 538-04-11-12
Report No.(s): NASA/TM-1999-209552; NAS 1.15:209552; L-17892; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

A series of flight tests to measure the wake of a Lockheed C- 130 airplane and the accompanying atmospheric state have been conducted. A specially instrumented North American Rockwell OV-10 airplane was used to measure the wake and atmospheric conditions. An integrated database has been compiled for wake characterization and validation of wake vortex computational models. This paper describes the wake- measurement flight-data reduction process.
Author
Flight Tests; Wakes; Velocity Measurement; Mathematical Models; Procedures

19990110063 Royal Aeronautical Society, London, UK
Flight Safety- A Total Commitment
Flight Safety- A Total Commitment Proceedings; 1998; 73p; In English, Feb. 3, 1998, London, UK; See also 19990110064 through 19990110070; ISBN 1-85768-0197; Copyright; Avail: Issuing Activity (Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK); US Sales Only, Hardcopy, Microfiche

Contents include the following: a global view of flight safety concerns; type certification on new design concepts-SST (airworthiness requirements and new technology); service through safety-implications for flight crew training; train, inspect and audit - is there any other way?; flight safety in business aviation; maintaining existing ATC safety levels whilst responding to the demands of increasing traffic; and the investigation of accidents and incidents and lessons to be learned.
CASI
Aircraft Reliability; Flight Safety; Flight Training

19990110064 International Federation of Air Line Pilot Associations, Chertsey, UK
A global view of flight safety concerns
McInnis, R. J. (Ron), International Federation of Air Line Pilot Associations, UK; Flight Safety- A Total Commitment; 1998; 8p; In English; See also 19990110063; Copyright; Avail: Issuing Activity (Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, London, UK); US Sales Only, Hardcopy, Microfiche

Globalisation has become a commonplace word in the aviation industry. This paper examines the current safety concerns of the international pilot community and the trend for global airlines in the ever-increasing air traffic scenario. If the current increase in air traffic and its accident rate continues the industry could face a major accident every week in 10 years' time. Several areas of the world are recognized as being safety deficient; the reasons for these deficiencies are examined, together with graphic examples of accidents and incidents. An effective safety reporting system is called for one which can provide feedback without fear of prosecutions or job losses for those providing the reports. There still exists in some States the situation where the agency that makes the rules not also enforces them but also investigates the accidents. This is in direct contravention of the ICAO guidelines. The paper ends with a practical solution on what can be done to provide positive answers to the problems.
Author
Flight Safety; Feedback; Commercial Aircraft; Airline Operations; Air Traffic

19990110065 Royal Aeronautical Society, London, UK

Type certification on new design concepts-SST

Baker, P. P., Royal Aeronautical Society, UK; 1998; 28p; In English; See also 19990110063; Copyright; Avail: Issuing Activity (Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK); US Sales Only, Hardcopy, Microfiche

Keeping up to date with aircraft development is an imperative requirement for the Certification Authorities if they are not to lose credibility and if a comparable, if not improved, level of safety is to be maintained. In the case of Concorde it is thought this objective was achieved. However, safety is always balanced between cost and practicability and Concorde was fortunate in having been publicly funded throughout. It is ,perhaps, interesting to speculate if such an elaborate set of requirements would have emerged had the aircraft been manufactured privately. Certainly Government Institutional support was 'heavy' and the Certification Authorities were clearly encouraged to act similarly and in fact were 'used' to not only monitor, but also to approve, the early flight test programme, something which is not their usual role. As is well known the project was not cheap. It should be remembered that Certification Authorities are funded differently. Some, like the CAA, charge for their services and have to 'pay their way'. Others, like the FAA, are paid for by the tax payer (and ticket purchaser) and have to meet an annual fixed budget. The current trend to standardise requirements is applauded, naturally, not least by the manufactures and purchasers of aircraft, who stand to gain the most. Agreement on common standards, however, inevitably leads to compromise, and where funding is a problem, ready acceptance of the work of others - the net result can mean that safety is the loser. Setting a rigorous standard in one comparatively small body is much easier than applying a world wide universal set of rules with a world wide set of vested interests to go with them. It is hard to say that an accident should never have happend, since it is an accident. Nevertheless, such a description seems to suit a number of recent accidents to new 'equipment'. There certainly is no room for complacency and the combination of new technology and the desire to compromise standards could be an unfortunate one.

Author

Aircraft Design; Flight Tests; Safety

19990110066 British Midland Airways, London, UK

Service through safety - Implications for flight crew training

Harris, D. H. R., British Midland Airways, UK; 1998; 2p; In English; See also 19990110063; Copyright; Avail: Issuing Activity (Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK); US Sales Only, Hardcopy, Microfiche

Aviation is a very complex and changing environment. One of the possible problems that we have to recognize is that of culture, the culture of the operators and of the passengers. The challenge facing the trainer is to increase the level of awareness of crews during the different phases of flight. It is widely accepted that the most critical phases of flight are the take-off and landing. The investigation of incidents and accidents frequently points to crew error, in one form or other, as being a key factor. What we must never lose sight of is that this must only be achieved through a safe operating environment.

Derived from text

Safety; Flight Training; Flight Crews; Errors; Services

19990110067 Civil Aviation Authority, Flight Operations Standards, London, UK

'Train, inspect and audit' - Is there any other way?

Carver, T., Civil Aviation Authority, UK; 1998; 7p; In English; See also 19990110063; Copyright; Avail: Issuing Activity (Royal Aeronatical Society, 4 Hamilton Place, London, W1V 0BQ, UK); US Sales Only, Hardcopy, Microfiche

Is there anything new for us in aviation safety? What is changing to affect aviation? Is there any need to chang what we do to ensure safe air transport? This paper will consider some of these changes and their impact, arguing that, whereas external events may chang our technology, the human resource which is still central to our industry, remains constant in its failings which affect air safety whether operating with pilotless aircraft or skillfully handled bi-plane. The paper will consider air safety and commerce as a combination in a total commitment of engineer, pilot, operator and regulator, and will continue the argument to show that air safety can be maintained and enhanced mainly by concentration on Training, Inspecting and Auditing. It will conclude that no single element of the aviation industry can abrogate or delegate to any other element, all of its activities and responsibilities under any one of the three headings.

Author

Aircraft Safety; Education; Flight Safety; Human Resources; Regulators

19990110068 Civil Aviation Authority, London, UK

Flight safety in business aviation

Robinson, J. B., Civil Aviation Authority, UK; 1998; 6p; In English; See also 19990110063; Copyright; Avail: Issuing Activity (Royal Aeronatical Society, 4 Hamilton Place, London, W1V 0BQ, UK); US Sales Only, Hardcopy, Microfiche

Business Aviation has an essential role in the commercial, financial and industrial viability of the World. It provides governments, corporations and companies with a flexible, secure service to any destination world-wide without the problems associated with travel by the rigid network of the scheduled airlines. Due to the steady increase in the demand by the public for air travel, and despite the great advance in information technology and communications, the need for Business Aviation is increasing which is born out by the demand for and introduction of very long range business jet aircraft, to meet this demand Business Aviation has to achieve the highest standards of flying operations in aviation in an evermore crowded environment and with new technology which is not always user-friendly. At times resources are stretched to then limits and it is beholden to the Business Aviation community to ensure that it achieves its tasks with the utmost safety. A first look at the safety record for Business Aviation appears to show that all-is-well and that it is one of the safest means of transport in the World, but there are specific areas that do need attention if the number of accidents/incidents is to be reduced and, hopefully eliminated. .

Author

Airline Operations; Commercial Aircraft; Flight Safety; Jet Aircraft; Viability

19990110069 Board of Trade, London, UK

Maintaining existing ATC safety levels whilst responding to the demands of increasing traffic

Ennis, George, Board of Trade, UK; 1998; 6p; In English; See also 19990110063; Copyright; Avail: Issuing Activity (Royal Aeronatical Society, 4 Hamilton Place, London, W1V 0BQ, UK); US Sales Only, Hardcopy, Microfiche

This paper explains how NATS plans to maintain or reduce the overall number of ATC induced safety incidents regardless of the rate of traffic growth. It summarizes the current air traffic situation in Europe and explains NATS' approach to managing safety. It highlights a current safety issue and illustrates how NATS is improving safety year-on-year, in particular how human factor issues are being addressed. The paper examines future ATC developments in terms of the technology and the new operating concepts needed to enhance capacity, safely and cost effectively, in line with growing demand.

Author

Air Traffic Control; Safety; Incidence

19990110070 Department of Transport, Air Accidents Investigation Branch, Farnborough, UK

The investigation of accidents and incidents and lessons to be learned

Whidborne, Richard StJ, Department of Transport, UK; 1998; 14p; In English; See also 19990110063; Copyright; Avail: Issuing Activity (Royal Aeronatical Society, 4 Hamilton Place, London, W1V 0BQ, UK); US Sales Only, Hardcopy, Microfiche

The paper discusses the investigation of accidents and incidents from the perspective of a government investigation body. The attitudes of different parties towards a major occurrence, and their objectives, are discussed before describing some aspects of the methodology used in investigation. The lessons to be learned are described in terms of a 'product' which comprises the identification of safety deficiencies and consequent recommendations. The closure of recommendations by recipients is discussed in terms of acceptance and implementation by the regulatory authorities.

Author

Accident Investigation; Incidence

19990111541 Belgrade Univ., Yugoslavia

Determining Usability Versus Cost and Yields of a Regional Transport

Givozdenovic, Slobodan, Belgrade Univ., Yugoslavia; Journal of Air Transportation World Wide; 1999; Volume 4, No. 2, pp. 1-21; In English; See also 19990111540; Copyright; Avail: Issuing Activity, Hardcopy

Regional transports are designed to operate on air networks having the basic characteristics of short trip distances and low density passengers/cargo, i.e. small numbers of passengers per flight. Regional transports passenger capacity is from 10 to 100 seats and operate on routes from 350 to 1000 nautical miles (nm). In order to meet passenger requirements providing low fares and high or required number of frequencies, airlines must constantly monitor operational costs and keep them low. It is obvious that costs of operating aircraft must be lower than yield obtained by transporting passengers and cargo. The requirement to achieve favorable yield/cost ratio must provide the answer to the question of which aircraft will best meet a specific air network (Simpson, 1972). An air network is defined by the number of services, the trip distance of each service, and the number of flights (frequencies) per day and week.

Derived from text

Airline Operations; Operating Costs; Air Cargo; Civil Aviation; Commercial Aircraft; Passengers

19990111542 University of Southern Georgia, Statesboro, GA USA

Outsourcing as an Airline Strategy

Rutner, Stephen M., University of Southern Georgia, USA; Brown, John H., University of Southern Georgia, USA; Journal of Air Transportation World Wide; 1999; Volume 4, No. 2, pp. 22-31; In English; See also 19990111540; Copyright; Avail: Issuing Activity, Hardcopy

Since the deregulation of the airline industry, carriers have searched for any method to improve their competitive position. At the same time, there has been a growth in the use of Third Party Logistics throughout corporate America. This paper presents an overview of the Third Party Logistics system of outsourcing and insourcing within the airline industry. This discussion generated a number of propositions, possible future scenarios and opportunities for empirical testing.

Author

Airline Operations; Air Transportation

19990111543 Jordan Univ. of Science and Technology, Irbid, Jordan

Stochastic Modeling of Airlines' Scheduled Services Revenue

Hamed, M. M., Jordan Univ. of Science and Technology, Jordan; Journal of Air Transportation World Wide; 1999; Volume 4, No. 2, pp. 32-48; In English; See also 19990111540; Copyright; Avail: Issuing Activity, Hardcopy

Airlines' revenue generated from scheduled services account for the major share in the total revenue. As such, predicting airlines' total scheduled services revenue is of great importance both to the governments (in case of national airlines) and private airlines. This importance stems from the need to formulate future airline strategic management policies, determine government subsidy levels, and formulate governmental air transportation policies. The prediction of the airlines' total scheduled services revenue is dealt with in this paper. Four key components of airline's scheduled services are considered. These include revenues generated from passenger, cargo, mail, and excess baggage. by addressing the revenue generated from each schedule service separately, air transportation planners and designers are able to enhance their ability to formulate specific strategies for each component. Estimation results clearly indicate that the four stochastic processes (scheduled services components) are represented by different Box-Jenkins ARIMA models. The results demonstrate the appropriateness of the developed models and their ability to provide air transportation planners with future information vital to the planning and design processes.

Author

Air Transportation; Airline Operations; Schedules; Services; Revenue; Stochastic Processes; Regression Analysis; Econometrics; Time Series Analysis

19990111545 Cranfield Univ., Bedford, UK

The Effect of Corporate Influence in the Short Haul Business Travel Market

Mason, Keith J., Cranfield Univ., UK; Journal of Air Transportation World Wide; 1999; Volume 4, No. 2, pp. 66-83; In English; See also 19990111540; Copyright; Avail: Issuing Activity, Hardcopy

The importance of corporate involvement in the decision making process for business related air travel is being increasingly recognised in the literature. Business travellers consume air services (i.e. they take airline flights), however; they may not be the principal decision-maker in the purchase. Also it is the organization that employs the traveller that incurs the cost for air travel. Consequently this research addresses the relationship between the traveller and the employing organisation in the purchase of air travel. In this paper traveller opinions on their corporate travel policy are evaluated using a Likert summated rating scale. The benefits sought, by the traveller, from the air service are also investigated and these benefits are used to segment the short haul business air travel market in the EU. Changes in the market for short haul business travel since the full liberalisation of the aviation market in the EU are evaluated by comparing the data to an earlier study of similar travellers in 1992.

Author

Air Transportation; Airline Operations; Short Haul Aircraft; Passenger Aircraft; Passengers

19990111546 Cranfield Univ., Bedford, UK

The Role of Capital Productivity in British Airways' Financial Recovery

Morrell, Peter, Cranfield Univ., UK; Journal of Air Transportation World Wide; 1999; Volume 4, No. 2, pp. 84-99; In English; See also 19990111540; Copyright; Avail: Issuing Activity, Hardcopy

British Airways (BA) was privatised in 1987, but its financial recovery occurred a number of years earlier. This recovery was sustained throughout the early 1990s economic recession, a period when few major airlines were operating profitably. This paper examines the role of productivity developments at British Airways from the early 1980s through 1996. The emphasis is on capital productivity and investment, but changes in capital intensity and labour productivity are also evaluated. Various measures are considered for both capital and labour productivity: outputs are measured in available tonne-kms (ATKS) and revenue tonne-kms

(RTKs), with the former preferred over the latter two measures, after adjustment for work performed by BA for others. Capital inputs are measured in equivalent lease costs adjusted to constant prices with a different treatment of flight and ground equipment or assets. Labour inputs are derived from total payroll costs deflated by a UK wage price index. The airline made considerable capital investments over the period and at the same time went through two major processes of labour restructuring. This resulted in a gradual increase in capital intensity, relative high labour productivity growth, but poor capital productivity performance. However, capital investment played an important role in the airline's sustained labour and total factor productivity over the whole period.

Author

Airline Operations; Operating Costs; Labor; Productivity

19990111548 Directorate General of Civil Aviation, The Hague, Netherlands

Benchmark Airport Charges

deWit, A., Directorate General of Civil Aviation, Netherlands; Cohn, N., Hague Consulting Group, Netherlands; Journal of Air Transportation World Wide; 1999; Volume 4, No. 2, pp. 121-144; In English; See also 19990111540; Copyright; Avail: Issuing Activity, Hardcopy

The Netherlands Directorate General of Civil Aviation (DGCA) commissioned Hague Consulting Group (HCG) to complete a benchmark study of airport charges at twenty eight airports in Europe and around the world, based on 1996 charges. This study followed previous DGCA research on the topic but included more airports in much more detail. The main purpose of this new benchmark study was to provide insight into the levels and types of airport charges worldwide and into recent changes in airport charge policy and structure. This paper describes the 1996 analysis. It is intended that this work be repeated every year in order to follow developing trends and provide the most up-to-date information possible.

Author

Airports; Policies; Trends; Trend Analysis

19990111692 National Air and Space Museum, Washington, DC USA

Fifty Years of Transatlantic Flight

Smith, Richard K., National Air and Space Museum, USA; 1969; In English; 6th; Annual Meeting and Technical Display, 20-24 Oct. 1969, Anaheim, CA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): AIAA Paper 69-1044; Copyright; Avail: Issuing Activity, Hardcopy

The history of transatlantic flight can be divided into seven periods. They are not all distinct in time; during the first twenty years they overlap to a considerable extent. But for convenience they may be summarized L (1) the great flights, 1919-1924; (2) the barnstorming, 1926-1938; (3) the heyday of the airship, 1919-1937; (4) the dawn of commercial airplane operations, 1935-1939; (5) World War II; (6) the post-war airs crew period, 1945-1957; and (7) the first generation of the jet era, 1958-1969.

Derived from text

Commercial Aircraft; Transoceanic Flight; Histories

19990113073 Federal Aviation Administration, Washington, DC USA

Notices to Airmen Domestic/International, May 20, 1999

May 20, 1999; 290p

Report No.(s): PB99-153736; No Copyright; Avail: CASI; A13, Hardcopy; A03, Microfiche

Table of Contents: Airway Notams; Airports, Facilities, and Procedural Notams; General FDC Notams; Part 95 Revisions to Minimum En Route IFR Altitudes and Changeover Points; International Notices to Airmen; Graphic Notices (General Information; Special Military Operations; Major Sporting and/or Entertainment Events; Northeast USA; Southeast USA; East Central United States; South Central USA; North Central USA; Northwest USA; Southwest USA; and Alaska/Hawaii).

NTIS

Air Navigation; Airports; National Airspace System; Charts

19990113078 National Transportation Safety Board, Washington, DC USA

National Transportation Safety Board Transportation Initial Decisions and Orders and Board Opinions and Orders Adopted and Issued during the Month of May 1999

May 1999; 366p

Report No.(s): PB99-916705; NTSB/IDBOO-99/05; No Copyright; Avail: CASI; A16, Hardcopy; A03, Microfiche

This publication contains all Judge Initial Decisions and Board Opinions and Orders in Safety and Seaman Enforcement Cases for May 1999.
NTIS
Air Transportation; Accident Prevention; Safety Management

19990114963 Naval Air Warfare Center, Aircraft Div., Patuxent River, MD USA
Safety of Flight: The Physiologic Aspect of the Weapon System
Forster, Estrella; Jun. 06, 1999; 5p; In English
Report No.(s): AD-A367872; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche
The use of naval platform is continuing to undergo downsizing and therefore those aircrew and aircraft who/which remain are becoming more valuable. Additionally, "pilot error" continues to be the principal cause of aircraft accidents and incidents leading to fatalities or losses over 1 million dollars (Class A mishaps). Indeed, Controlled Flight into Terrain (CFIT), Loss of Situational Awareness (LSA), Failure of Aircrew Coordination (FAC), Mid-Air Collisions (MAC), spatial Disorientation (SD), and Altered States of Awareness (ASA) from simple confusion to "almost" and frank G-induced loss of consciousness (A-LOC and G-LOC) account for over 50% of material losses. These losses may not be an error in the part of the pilot but rather the result of a physiologic event over which the pilot has essentially no control and limited protection. Accident investigation boards who identify a mishap cause(s) necessarily select it from a chain of events. The finding of "pilot error" may then be an attractive solution whenever the data available does not identify equipment, engine, or other component failure as the cause of the accident. This is probably especially true given the political environment under which these boards may be constrained. Moreover, the pilot may not be around to explain him/herself. Finally, certain accidents and incidents may very well be due to ASA but misclassified as LSA, SD, FAC, MAC, etc. for lack of relevant data. This data being the physychophysiologic state of the pilot.
DTIC
Weapon Systems; Aircraft Safety; Aircraft Accidents; Disorientation

19990114986 National Transportation Safety Board, Washington, DC USA
National Transportation Safety Board Aircraft Accident Report: Uncontrolled Descent and Collision with Terrain USAIR Flight 427, Boeing 737-300, N513AU Near Aliquippa, Pennsylvania, September 8, 1994
Mar. 24, 1999; 370p; In English; Original contains color illustrations
Report No.(s): PB99-910401; NTSB/AAR-99/01; No Copyright; Avail: CASI; A16, Hardcopy; A03, Microfiche
This report explains the accident involving USAir flight 427, a Boeing 737-300, which entered an uncontrolled descent and impacted terrain near Aliquippa, Pennsylvania, on September 8, 1994. Safety issues in the report focused on Boeing 737 rudder malfunctions, including rudder reversals; the adequacy of the 737 rudder system design; unusual attitude4 training for air carrier pilots; and flight data recorder parameters.
NTIS
Aircraft Accidents; Aircraft Safety; Flight Safety; Safety Management; Accident Prevention; Aircraft Accident Investigation; Collisions

19990115003 Army Safety Center, Fort Rucker, AL USA
FLIGHTFAX: Army Aviation Risk-Management Information, Volume 27, Number 8
Aug. 1999; 12p; In English
Report No.(s): AD-A367734; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This document contains information concerning Army Aviation Safety. In this issue there are several historical articles on weather risk.
DTIC
Weather; Information Management; Management Information Systems

19990116332 Department of Defense, Office of the Inspector General, Arlington, VA USA
Follow up Audit of the European Theater C-9A Aircraft Flying Hour Program
May 05, 1999; 33p; In English
Report No.(s): AD-A366973; AR-99-147; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy
The audit objective was to review the flying hour program to determine the flying hours required, considering a redefined mission for the C-9A aircraft and the flying hours necessary to meet air crew training requirements. We followed up on recommendations in Inspector General, DoD, Report No. 97-192. We did not review the management control program as it relates

to the overall audit objective because controls related to the aeromedical evacuation program were covered in Inspector General, DoD, Report No. 95-225, Aeromedical Evacuation System, June 9, 1995.
DTIC
Air Transportation; Flight Training; Aircraft Maneuvers

19990116466 Naval Air Warfare Center, Aircraft Div., Patuxent River, MD USA
Adaptation of a Ground Proximity Warning System for Rotorcraft
Schueler, Doug; Durkin, John; Funchion, Rick; Apr. 05, 1999; 8p; In English
Report No.(s): AD-A368640; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Ground Proximity Warning Systems have experienced considerable success as a safety backup device for fixed wing aircraft applications. Transferring this concept to a Rotorcraft, however, requires compensation for a type of aircraft that is intentionally flown at low altitudes, relatively slow airspeeds, and in most cases, provides no definitive cues as it transitions to a landing or hovering state. NAVAIRSYSCOM has chosen a system for selected helicopters in the Navy and Marine Corps inventory which has shown considerable promise during developmental and operational testing. The system incorporates a predictive warning algorithm that issues warnings based on the dynamic state of the aircraft rather than fixed altitudes alone. Other available features include a pilot-selectable altitude warning, as well as warnings for excessive bank angle, gear-up landing, tail strike, descent below ILS glide slope, and altitude loss immediately after takeoff.
DTIC
Helicopters; Warning Systems; Aircraft Configurations

19990116478 Naval Air Warfare Center, Aircraft Div., Patuxent River, MD USA
The Use of Ejection Simulation in Mishap Investigations
Nichols, Jeffrey P.; Sep. 10, 1998; 9p; In English
Report No.(s): AD-A368764; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Modeling and simulation of ejection events can be a valuable tool in the investigations of aircraft mishaps. Engineers at NAVAIRSYSCOM Patuxent River, Maryland, frequently utilize 6 degree-of-freedom modeling and simulation to aid in mishap investigations. Simulations are used to reenact the mishap and evaluate many aspects of the event. Initial conditions and impact conditions can be examined; the time when the envelope for safe ejection was exceeded can be determined; possible system malfunctions can be investigated, and possible improvements to the seat systems can be evaluated using the actual mishap conditions.
DTIC
Ejection Seats, Aircraft Safety; Aircraft Accidents; Ejection

19990116652 Naval Air Warfare Center, Aircraft Div., Patuxent River, MD USA
Low Cost Solutions for Automation of Simulation Test and Reporting
Munday, Richard B.; Jun. 04, 1999; 15p; In English
Report No.(s): AD-A368451; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

High efficiency in the conduct of flight and simulation test usually involves high costs to achieve. Traditional methods of test automation often involve expensive, customized hardware and software systems, requiring lengthy procurement and long lead times. However, automation is highly desirable as it leads to repeatability, minimizes schedule uncertainty, and maximizes asset use. Four separate areas were targeted for low cost automation of simulation testing: Test setup, test conduct, data retrieval, and data reduction. The automation processes used were chosen based upon the following criteria: minimal program delays, minimal training, minimal workload to implement, flexibility for future uses, and compatibility with existing systems and methods. Through the use of automated processes on existing hardware and software, total time and cost required to complete complex simulation tests were greatly reduced while improving the quality of results.
DTIC
Computer Programs; Low Cost; Flight Simulation; Software Engineering

19990116754 Royal Aeronautical Society, London, UK
The Potential of Rotorcraft to Increase Airport Capacity: Proceedings
1999; 124p; In English, 19 Oct. 1999, London, UK; See also 19990116755 through 19990116762; ISBN 1-85768-167-2; Copyright; Avail: Issuing Activity, Hardcopy

This paper presents conference proceedings on The Potential of Rotocraft to Increase Airport Capacity. Topics include: 1) Current Scheduled Helicopter Operations; (Malmo/Copenhagen, Vancouver/Victoria Island, History of the Penzanzce/ Scilly

Service, and A survey of Rotorcraft Suitable for Scheduled Operations); 2) Public Acceptability of Rotorcraft: (Public Acceptance of Rotorcraft: The Issues and Tiltrotor Development to Meet Public Acceptability Targets); 3) European Developments: (Rotorcraft Technology and Products 2005/2015 and A Review of European Research Initiatives); 4) Air Traffic and Airport Management: (Air Traffic Management Capacity Constraints on and Around Airports, Integrated Rotorcraft/Verticle Flight Operations to Reduce Delay and Increase Capacity, Capacity Increase at Frankfurt International Airport, and Operational Economics-Air Airlines Perspective/The Way Ahead).
CASI
Helicopters; Rotary Wing Aircraft; Airports; Conferences; Commercial Aircraft; Civil Aviation; Air Traffic Control

19990116755 Helikopter Service A.B., Sweden
Malmo/Copenhagen
Gunnarsson, S., Helikopter Service A.B., Sweden; The Potential of Rotocraft to Increase Airport Capacity: Proceedings; 1999, pp. 1.1 - 1.6; In English; See also 19990116754; Copyright; Avail: Issuing Activity, Hardcopy
This paper presents viewgraphs of Malmo/Copenhagen from zero to over 16,000 yearly flights with 85,000 passengers.
CASI
Helicopters; Airports; Airline Operations; Sweden

19990116756 British International Helicopters Ltd., Oxford, UK
History of the Penzanace: Isles of Scilly Service
Nelson, R. T., British International Helicopters Ltd., UK; The Potential of Rotocraft to Increase Airport Capacity: Proceedings; 1999, pp. 3.1 - 3.7; In English; See also 19990116754; Copyright; Avail: Issuing Activity, Hardcopy
Aviation first came to the Isles of Scilly during the Great War, when a Royal Naval Air Station was established on Tresco in February 1917, later to be disbanded in May 1919. (This squadron operated flying boats and seaplanes). The first aircraft to land on the Isles was a De Havilland Moth which landed on the golf course in August 1929. The first scheduled air service to the Islands was operated by Channel Air Ferries and commenced operation on 15t" September 1937. They used the twin engined De Havilland Dragon. The golf course was used as the airfield on the Islands and the newly opened Lands End Aerodrome was the mainland airfield. In July 1939 a new airport was opened on St Mary's and this is the site of today's airport. Up to the outbreak of war this service had carried 10,000 passengers and because it was deemed as being an essential air route it was kept operational throughout the duration of the war, (the aircraft being in camouflage). During the war the airport on Scillies was also the home of 87 Squadron, (a hurricane squadron), which was disbanded in September 1944.
Derived from text
Helicopters; Heliports; UK; Aeroquatic Vehicles

19990116757 American Helicopter Society, Inc., Alexandria, VA USA
Public Acceptance of Rotorcraft: The Issues
Pike, A. C., Westland Helicopters Ltd., UK; Leverton, J. W., American Helicopter Society, Inc., USA; The Potential of Rotocraft to Increase Airport Capacity: Proceedings; 1999, pp. 5.1 - 5.11; In English; See also 19990116754; Copyright; Avail: Issuing Activity, Hardcopy
The impact of helicopter noise on the public at large has become more important in recent years and is one of the main attributes of this type of aircraft inhibiting the expansion of helicopter operations and the development of heliports. There appears to be a marked disparity between public acceptance of helicopter operations and the level of intrusion inferred from the most common methods for rating noise disturbance in the community. The peculiar characteristics of rotor noise which might explain why helicopters are singled out for special attention and ways in which the problem may be resolved by operational techniques and, in the longer term, design changes are discussed in detail.
Author
Aircraft Noise; Rotary Wing Aircraft; Heliports; Rotor Aerodynamics

19990116808 Federal Aviation Administration, Washington, DC USA
Notices to Airmen, Domestic/International, August 12, 1999
Aug. 12, 1999; 234p; In English
Report No.(s): PB2000-100702; No Copyright; Avail: CASI; A11, Hardcopy; A03, Microfiche

Contents include the following: Airway Notams; Airports, Facilities and Procedural Notams; General FDC Notams; Part 95 Revisions to Minimum En Route IFR Altitudes and Changeover Points; International Notices to Airmen; and Graphic Notices.
NTIS
Air Navigation; Runways; Airports; National Airspace System; Graphs (Charts)

19990116851 NASA Ames Research Center, Moffett Field, CA USA
Crew Factors in Flight Operations X: Alertness Management in Flight Operations
Rosekind, Mark R., NASA Ames Research Center, USA; Gander, Philippa H., San Jose State Univ., USA; Connell, Linda J., NASA Ames Research Center, USA; Co, Elizabeth L., San Jose State Univ., USA; April 1999; 96p; In English
Contract(s)/Grant(s): RTOP 548-30-32
Report No.(s): NASA/TM-1999-208780; NAS 1.15:208780; DOT/FAA/RD-93/18; A-99V0020; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

In response to a 1980 congressional request, NASA Ames Research Center initiated a Fatigue/Jet Lag Program to examine fatigue, sleep loss, and circadian disruption in aviation. Research has examined fatigue in a variety of flight environments using a range of measures (from self-report to performance to physiological). In 1991, the program evolved into the Fatigue Countermeasures Program, emphasizing the development and evaluation of strategies to maintain alertness and performance in operational settings. Over the years, the Federal Aviation Administration (FAA) has become a collaborative partner in support of fatigue research and other Program activities. From the inception of the Program, a principal goal was to return the information learned from research and other Program activities to the operational community. The objectives of this Education and Training Module are to explain what has been learned about the physiological mechanisms that underlie fatigue, demonstrate the application of this information in flight operations, and offer some specific fatigue counter-measure recommendations. It is intended for all segments of the aeronautics industry, including pilots, flight attendants, managers, schedulers, safety and policy personnel, maintenance crews, and others involved in an operational environment that challenges human physiological capabilities because of fatigue, sleep loss, and circadian disruption.
Author
Physiological Factors; Flight Operations; Pilot Performance; Jet Lag; Flight Fatigue

19990116895 Electro Magnetic Applications, Inc., Denver, CO USA
High-Intensity Radiated Fields (HIRF) Risk Analysis *Final Report*
Elliot, James R.; Jul. 1999; 25p; In English
Report No.(s): AD-A369637; DOT/FAA/AR-99/50; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

This report details the results of a study that has been completed to assess the risk of High-Intensity Radiated Fields (HIRF) to fixed-wing transport and nontransport aircraft in the US The approach to the assessment of HIRF included the following elements: (1) Detailed information on 893 emitters and 5913 flights near Denver and Seattle; (2) Quantitative judgements from industry experts about onboard avionics with regard to type, properties, and response probabilities. (3) Electromagnetic environment levels from regulatory and standard sources DO-160B, DO-160C, and the proposed Notice of Proposed Rule making (NPRM). Certification field strength levels from the proposed NPRM, DO-160B, and DO-160C were used to calculate the probability of a HIRF-induced catastrophic aircraft event. No clear evidence was found that flights in the Denver and Seattle areas experienced a HIRF environment level greater than the NPRM certification levels. The probability of the HIRF-induced catastrophic events are presented as a quantitative assessment of the HIRF risks to aircraft safety.
DTIC
Risk; Aircraft Safety; Electromagnetic Fields

19990116933 National Transportation Safety Board, Washington, DC USA
National Transportation Safety Board Safety Recommendations Adopted during the Month of May, 1999
May 1999; 50p
Report No.(s): PB99-916605; NTSB/REC-99/05; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This publication contains safety recommendations in aviation (only) mode of transportation adopted by the National Transportation Safety Board during the month of May 1999.
NTIS
Transportation; Accident Prevention; Safety; Safety Management

19990116934 National Transportation Safety Board, Washington, DC USA

National Transportation Safety Board Safety Recommendations Adopted during the Month of April, 1999

Apr. 1999; 82p

Report No.(s): PB99-916604; NTSB/REC-99/04; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This publication contains safety recommendations in aviation (only) mode of transportation adopted by the National Transportation Safety Board during the month of April 1999.

NTIS

Accident Prevention; Safety Management; Safety

19990117049 Air Force Logistics Management Center, Gunter AFS, AL USA

A Comparison of Air Force Organic Airlift and Commercial Air Express Distribution Performance

Condon, Travis; Cunningham, William; Moore, Kevin; Patterson, Kirk; Oct. 1999; 6p; In English

Report No.(s): AD-A369474; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Several major differences exist between AMC organic airlift and commercial airlift. Foremost, AMC airlift is centered around channel service. A channel is a regularly scheduled mission over a fixed route with capacity available to all customers. A monthly schedule is published for both passenger and cargo channel missions, and a priority system is used to allocate airlift resources where demand exceeds AMC capabilities. in contrast to military organic transportation, express commercial carriers-such as Federal Express (FedEx), United Parcel Service, Airborne Express and Emery-are more responsive to customer demands and are able to adjust flight schedules and airlift capabilities on a daily basis if necessary. According to the Program Management Advisor for FedEx, they are able to fly an additional aircraft with only a few hours notice if necessary to ensure the on-time arrival of cargo. Commercial express carriers have structured their business practices to ensure speedy, reliable and flexible delivery.

DTIC

Commercial Aircraft; Airline Operations; Comparison

19990117125 Nebraska Univ., Aviation Inst., Omaha, NE USA

The Symposium Proceedings of the 1998 Air Transport Research Group (ATRG), Volume 2

Reynolds-Feighan, Aisling, Editor, University Coll., Ireland; Bowen, Brent D., Editor, Nebraska Univ., USA; The Symposium Proceedings of the 1998 Air Transport Research Group (ATRG); December 1998; 278p; In English; Air Transport Research Symposium, 20-21 Jul. 1998, Dublin, Ireland; Sponsored by World Conference on Transportation Research Society; See also 19990117126 through 19990117132

Contract(s)/Grant(s): NAGw-4414

Report No.(s): UNOAI-98-4; Copyright Waived; Avail: CASI; A13, Hardcopy; A03, Microfiche

The Air Transport Research Group of the World Conference on Transportation Research (WCTR) Society was formally launched as a special interest group at the 7th Triennial WCTR in Sydney, Australia in 1995. Since then, our membership base has expanded rapidly, and now includes over 400 active transportation researchers, policy-makers, industry executives, major corporations and research institutes from 28 countries. It became a tradition that the ATRG would hold an international conference at least once a year. In 1998, the ATRG organized a consecutive stream of 14 aviation sessions at the 8th Triennial WCTR Conference (July 12-17: Antwerp). Again, on 19-21 July, 1998, the ATRG Symposium was organized and executed very successfully by Dr. Aisling Reynolds-Feighan of the University College of Dublin. The Aviation Institute at the University of Nebraska at Omaha has published the Proceedings of the 1998 ATRG Dublin Symposium (being co-edited by Dr. Aisling Reynolds-Feighan and Professor Brent Bowen), and the Proceedings of the 1998 WCTR-ATRG Conference (being co-edited by Professors Tae H. Oum and Brent Bowen).

Author

Conferences; Air Transportation; Organizations; Mathematical Models; Airline Operations

19990117126 British Columbia Univ., Div. of Transportation and Logistics, Vancouver, British Columbia Canada

Globalization of Airline Networks and Airline Alliances

Oum, Tae Hoon, British Columbia Univ., Canada; Park, Jong-Hun, City Univ. of Hong Kong, Hong Kong; The Symposium Proceedings of the 1998 Air Transport Research Group (ATRG); December 1998; Volume 2; 14p; In English; See also 19990117125; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

This paper presents Globalization of Airline Networks and Airline Alliances. The topics include: 1) Background and Government Policy Towards Alliances; 2) Current Status of Alliances; 3) Area of joint activities; 4) Reasons for alliance formation; 5) Effects of Alliances on Carriers and Passengers; and 6) Summary and Future Research Needs.
CASI
Airline Operations; Government/Industry Relations; Air Traffic

19990117127 City Univ. of Hong Kong, Dept. of Economics and Finance, Kowloon, Hong Kong
Strategic Airline Alliances: Complementary Versus Parallel Alliances
Park, Jong-Hun, City Univ. of Hong Kong, Hong Kong; Zhang, Anming, City Univ. of Hong Kong, Hong Kong; The Symposium Proceedings of the 1998 Air Transport Research Group (ATRG); December 1998; Volume 2; 32p; In English; See also 19990117125; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Strategic alliances have occurred in a broad spectrum of industries including the airline industry. This paper presents a model that examines the effects on market outcome and welfare of two types of strategic airline alliances: complementary vs. parallel alliances. It is identified that the two alliances have different effects on total output and consumer surplus. The complementary alliance is likely to increase total output, while the parallel alliance is likely to decrease it. Consequently, the former increases consumer surplus, while the latter is likely to decrease it. We find sufficient conditions under which each type of alliance improves total welfare. The emperical test results from the trans-Atlantic alliance routes for the 1990-94 period, confirm the theoretical predictions on partners" outputs and total output.
Author
Airline Operations; Mathematical Models; Industries; Market Research

19990117128 Boeing Commercial Airplane Co., Seattle, WA USA
Analysis of Airline Schedules Using Boeing's Decision Window Model
Soncrant, Charles, Boeing Commercial Airplane Co., USA; The Symposium Proceedings of the 1998 Air Transport Research Group (ATRG); December 1998; Volume 2; 22p; In English; See also 19990117125; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

This presentation employs Boeing's Decision Window Path Preference Model to analyze an airline's schedule or the schedules of a group of airlines. The results of the analysis are presented as "Coverage" which is defined as the fraction of passengers whose travel requirements are satisfied by the flights offered by a schedule. The agenda for the presentation consists of the following: First, the background will be presented for an airline system which is to be analyzed as an example. Next, there is a brief explanation of Boeing's Decision Window Path Preference model. This model was presented in more depth at the first meeting of the Air Transport Research Group (ATRG) on June 27, 1997, in Vancouver. The Decision Window model leads to the concept of Coverage, which will provide the basis for analyzing the example airline system. Next, the results of the Coverage analysis will be shown and, finally, some additional types of analysis for which Coverage can be used will be discussed.
Derived from text
Airline Operations; Decision Support Systems; Civil Aviation

19990117129 Lausanne Univ., DEEP-HEC, Switzerland
The Pros and Cons of Multi-Hub Structures in the Airline Industry
Romano, Elliot, Lausanne Univ., Switzerland; The Symposium Proceedings of the 1998 Air Transport Research Group (ATRG); December 1998; Volume 2; 26p; In English; See also 19990117125; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

In this paper, we investigate the cost arising for alternative network structures of a monopoly airline. We include airport operation, which is subject to diseconomies of scale, as well as the cost of transport which is subject to economies of densities. We find that in most circumstances, the monopoly airline will find profitable to operate either a point-to-point network or a central hub, the "bang-bang" solution. It is only in the presence of different cost functions for hubs and spoke airports that network featuring multi-hub will be profitable.
Author
Airline Operations; Mathematical Models; Airports; Economic Analysis; Hubs

19990117130 British Columbia Univ., Faculty of Commerce and Business Administration, Vancouver, British Columbia Canada
Productivity, Prices and Profitability Trends in the World's Major Airlines, 1986-1995
Waters, W. G., II, British Columbia Univ., Canada; Oum, Tae Hoon, British Columbia Univ., Canada; Yu, Chunyan, British Columbia Univ., Canada; The Symposium Proceedings of the 1998 Air Transport Research Group (ATRG); December 1998;

Volume 2; 29p; In English; See also 19990117125; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

This paper tracks indices of prices paid for airline inputs relative to the prices received for airline outputs (labelled "total price performance," TPP) in comparison with trends in total factor productivity TFP (ratio of output and input quantity indices). Comparing TFP and TPP reveals the sharing of productivity gains between a company and its customers, and hence the change in the firms profitability. This is a variation of a model associated with the American Productivity Center (1981) used by a number of authors. This is an update of the paper presented at the Air Transport Research Group (ATRG) conference a year ago. Data are for 22 of the world's major air carriers. The output quantity index incorporates five output categories: revenue passenger kilometers from scheduled services, freight tonne-kilometres, non-scheduled passenger and freight services, mail service, and incidental revenues. There are five input categories: labour, fuel, flight equipment, ground property and equipment, and "materials and other inputs". The input and output price indices are dual to the respective input and output quantity indices: total revenues from all services divided by the output index provides the output price index; total costs (including full costs of capital) divided by the input quantity index produces in input price index. The profitability measure is the ratio of total revenues to total economic costs. The multilateral indices enable direct absolute comparisons among airlines of output and input levels, productivity, prices and price performance and profitability.

Author

Productivity; Airline Operations; Trends; Mathematical Models; Economics

19990117131 Nebraska Univ., Aviation Inst., Omaha, NE USA

Enhancing Global Competitiveness: Benchmarking Airline Operational Performance in Highly Regulated Environments

Bowen, Brent D., Nebraska Univ., USA; Headley, Dean E., Wichita State Univ., USA; Kane, Karisa D., Nebraska Univ., USA; The Symposium Proceedings of the 1998 Air Transport Research Group (ATRG); December 1998; Volume 2; 10p; In English; See also 19990117125; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Enhancing competitiveness in the global airline industry is at the forefront of attention with airlines, government, and the flying public. The seemingly unchecked growth of major airline alliances is heralded as an enhancement to global competition. However, like many mega-conglomerates, mega-airlines will face complications driven by size regardless of the many recitations of enhanced efficiency. Outlined herein is a conceptual model to serve as a decision tool for policy-makers, managers, and consumers of airline services. This model is developed using public data for the USA (U.S.) major airline industry available from the U/S. Department of Transportation, Federal Aviation Administration, the National Aeronautics and Space Administration, the National Transportation Safety Board, and other public and private sector sources. Data points include number of accidents, pilot deviations, operational performance indicators, flight problems, and other factors. Data from these sources provide opportunity to develop a model based on a complex dot product equation of two vectors. A row vector is weighted for importance by a key informant panel of government, industry, and consumer experts, while a column vector is established with the factor value. The resulting equation, known as the national Airline Quality Rating (AQR), where Q is quality, C is weight, and V is the value of the variables, is stated Q=C[i1-19] x V[i1-19]. Looking at historical patterns of AQR results provides the basis for establishment of an industry benchmark for the purpose of enhancing airline operational performance. A 7 year average of overall operational performance provides the resulting benchmark indicator. Applications from this example can be applied to the many competitive environments of the global industry and assist policy-makers faced with rapidly changing regulatory challenges.

Author

Airline Operations; Mathematical Models; Quality Control; Regulations; Industries

19990117132 Australian National Univ., Australia-Japan Research Centre, Canberra, Australia

Measuring the Competitiveness of International Airlines: Implications for Deregulation and Liberalisation of Global Aviation Markets

Tamms, Vanessa, Australian National Univ., Australia; The Symposium Proceedings of the 1998 Air Transport Research Group (ATRG); December 1998; Volume 2; 26p; In English; See also 19990117125; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

In this paper, I use annual data on 50 international scheduled airlines over the period 1982-1995 to estimate the approximate magnitude of the dead-weight-loss (DWL) in particular markets resulting from the restrictions on international trade in air transport services imposed by the terms of current Air Services Agreements (ASAs), and attempt to examine the various determinants of carrier efficiency. After estimating each carrier's "residual" total-factor-productivity (TFP) index (TFP adjusted for factors deemed to be beyond managerial control such as average stage length) using a simple Cobb-Douglas production function, I estimate a total variable cost function equation both including and excluding the estimated "residual" TFP index, and, using six simple assumptions, calculate the approximate DWL in 1995 associated with Japan Air Lines (JAL) providing output, both assuming that the carrier with "average" TFP faces Japanese factor prices and alternatively that factors are freely tradable

internationally. I then use the adjusted coefficients technique to estimate the frontier total variable cost equation and use this to estimate the DWL associated with JAL providing its output in 1995, assuming again that the highest TFP faces Japanese factor prices, and (alternatively) that factors are freely tradable internationally, by inspecting the significance (and sign) of the "residual" TFP index in the equations in which it is included. I also analyze whether or not we can assume that this index fully captures the effects of carrier technical efficiency (as well as technological progress) and hence determine both the relative magnitude of the effects of TFP on carrier total variable costs and (from the frontier total variable cost equation output) whether or not the carriers in my sample were allocatively efficient over the time period considered. I conclude firstly that my analysis of the markets served by JAL in 1995 supports the assertion that the gains from liberalisation would be greater the greater the extent to which current restrictions are relaxed (allowing more carriers to serve markets at minimum cost) and the greater the extent to which factors of production are freely tradable internationally, and secondly, that for the carriers in my sample over the time period considered, A one percent increase in TFP lowered carrier total variable costs by approximately 0.06% on average and that none of the carriers were allocatively efficient.

Author

Airline Operations; Air Transportation; Market Research; Productivity; Mathematical Models; Static Loads

19990117193 Naval Postgraduate School, Monterey, CA USA

Sensory Adaptation Effects Following Exposure to a Virtual Environment

Kaiser, Julie P.; Sep. 1999; 62p; In English

Report No.(s): AD-A369176; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The Navy's operational manual 3710.7Q states that flight personnel exhibiting symptoms of simulator exposure must abstain from same day flying duties, and those who have a history of simulator sickness must be removed from the flight schedule for at least 24 hours following simulator exposure. The cause of simulator sickness is currently unknown, but researchers hypothesize it results from a sensory input mismatch between the visual and vestibular sensory organs. Previous simulator sickness studies used questionnaires to measure sickness severity; however this is a crude measure with inconsistent findings. The goal of this study was to determine quantitatively whether low level sensory functions are disrupted in a virtual environment, and determine whether long term simulator exposure causes sensory adaptation. In order to answer these questions, smooth pursuit parameters, perceptual distance estimation, horizontal eye movements, and relative comfort level were measured before and after immersion in four different display formats. This study failed to find any statistically significant changes in low level vision functions. However, as with virtually every other study done on simulator sickness, this study did find statistically significant differences in comfort level (as measured with the Simulator Sickness Questionnaire) when using a head mounted display and a 3 panel display as compared to a control condition.

DTIC

Flight Simulation; Virtual Reality; Disorientation; Adaptation; Flight Simulators; Eye Movements; Signs and Symptoms

19990117197 Naval Postgraduate School, Monterey, CA USA

Low Cost Parachute Guidance, Navigation and Control

Dellicker, Scott H.; Sep. 1999; 141p; In English

Report No.(s): AD-A369203; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

The Affordable Guided Airdrop System (AGAS) integrates a low-cost guidance and control system into fielded cargo air delivery systems. This study evaluated the feasibility of this concept and included the design and execution of a flight test program to assess prototype system performance, as well as modeling efforts to develop initial guidance and control techniques leading to an evaluation of the feasibility of the AGAS concept. The flight test program provided adequate flight dynamic data for the AGAS system. The wind measurement techniques employed for this effort, through the use of a "calibration" parachute system, provided wind estimates that were not previously available.

DTIC

Parachutes; Guidance (Motion); Low Cost; Navigation; Control Systems Design

04
AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft, air navigation systems (satellite and ground based), and air traffic control.

19990106584 NASA Goddard Space Flight Center, Greenbelt, MD USA

Tracking the Relative Motion of Four Space Payloads Launched From a Sub-Orbital NASA Rocket

Martel, Hugh, Waypoint Consulting, Inc., Canada; Bull, Barton, NASA Goddard Space Flight Center, USA; [1999]; 6p; In English; ION GPS '99, 1999, Nashville, TN, USA; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

One problem, which is comparatively new in the field of GPS applications, is the determination of the relative trajectories of space vehicles. Applications include the docking of spacecraft, collision avoidance in the area of space stations, and trajectory reconstruction of multiple payloads. The required precision in any of these applications will vary, according to the requirements of the task and abilities of GPS to cope with the environment and the dynamics. This paper describes the post-mission reconstruction of the relative trajectories of four GPS receivers attached to four payloads jettisoned from a rocket in a sub-orbital NASA science mission. It is shown that the sub-decimetre level were achieved with single frequency GPS receivers.
Author

Global Positioning System; Receivers; Orbit Determination; Position Indicators; Spacecraft Tracking

19990108577 NASA Goddard Space Flight Center, Greenbelt, MD USA

Testing of the International Space Station and X-38 Crew Return Vehicle GPS Receiver *Final Report*

Simpson, James, NASA Goddard Space Flight Center, USA; Campbell, Chip, NASA Goddard Space Flight Center, USA; Carpenter, Russell, NASA Goddard Space Flight Center, USA; Davis, Ed, NASA Goddard Space Flight Center, USA; Kizhner, Semion, NASA Goddard Space Flight Center, USA; Lightsey, E. Glenn, Texas Univ., USA; Davis, George, Orbital Sciences Corp., USA; Jackson, Larry, Orbital Sciences Corp., USA; [1999]; 10p; In English; GPS Conference, 14-17 Sep. 1999, Nashville, TN, USA; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This paper discusses the process and results of the performance testing of the GPS receiver planned for use on the International Space Station (ISS) and the X-38 Crew Return Vehicle (CRV). The receiver is a Force-19 unit manufactured by Trimble Navigation and modified in software by the NASA Goddard Space Flight Center (GSFC) to perform navigation and attitude determination in space. The receiver is the primary source of navigation and attitude information for ISS and CRV. Engineers at GSFC have developed and tested the new receiver with a Global Simulation Systems Ltd (GSS) GPS Signal Generator (GPSSG). This paper documents the unique aspects of ground testing a GPS receiver that is designed for use in space. A discussion of the design of tests using the GPSSG, documentation, data capture, data analysis, and lessons learned will precede an overview of the performance of the new receiver. A description of the challenges that were overcome during this testing exercise will be presented. Results from testing show that the receiver will be within or near the specifications for ISS attitude and navigation performance. The process for verifying other requirements such as Time to First Fix, Time to First Attitude, selection/deselection of a specific GPS satellite vehicles (SV), minimum signal strength while still obtaining attitude and navigation, navigation and attitude output coverage, GPS week rollover, and Y2K requirements are also given in this paper.
Author

Global Positioning System; Navigation; Guidance (Motion); Navigation Satellites; Receivers; Signal Generators

19990108579 NASA Goddard Space Flight Center, Greenbelt, MD USA

Pre-Flight Testing of Spaceborne GPS Receivers Using a GPS Constellation Simulator

Kizhner, Semion, NASA Goddard Space Flight Center, USA; Davis, Edward, NASA Goddard Space Flight Center, USA; Alonso, Roberto, Argentine Space Agency, Argentina; [1999]; 11p; In English; ION GPS 1999 Conference, 14-17 Sep. 1999, Nashville, TN, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The NASA Goddard Space Flight Center (GSFC) Global Positioning System (GPS) applications test facility has been established within the GSFC Guidance Navigation and Control Center. The GPS test facility is currently housing the Global Simulation Systems Inc. (GSSI) STR2760 GPS satellite 40-channel attitude simulator and a STR4760 12-channel navigation simulator. The facility also contains a few other resources such as an atomic time standard test bed, a rooftop antenna platform and a radome. It provides a new capability for high dynamics GPS simulations of space flight that is unique within the aerospace community. The GPS facility provides a critical element for the development and testing of GPS based technologies i.e. position, attitude and precise time determination used on-board a spacecraft, suborbital rocket or balloon. The GPS simulator system is configured in a transportable rack and is available for GPS component development as well as for component, spacecraft subsystem and system level testing at spacecraft integration and test sites. The GPS facility has been operational since early 1996 and has been utilized by space flight projects carrying GPS experiments, such as the OrbView-2 and the Argentine SAC-A

spacecrafts. The SAC-A pre-flight test data obtained by using the STR2760 simulator and the comparison with preliminary analysis of the GPS data from $SAC_{-}A$ telemetry are summarized. This paper describes pre-flight tests and simulations used to support a unique spaceborne GPS experiment. The GPS experiment mission objectives and the test program are described, as well as the GPS test facility configuration needed to verify experiment feasibility. Some operational and critical issues inherent in GPS receiver pre-flight tests and simulations using this GPS simulator, and test methodology are described. Simulation and flight data are presented. A complete program of pre-flight testing of spaceborne GPS receivers using a GPS constellation simulator is detailed.

Author

Flight Simulation; Flight Tests; Global Positioning System; Guidance (Motion); Navigation; Navigation Satellites

19990110307 Civil Aeromedical Inst., Oklahoma City, OK USA

Controller Teamwork Evaluation and Assessment Methodology: A Scenario Calibration Study *Final Report*

Bailey, Larry L., Civil Aeromedical Inst., USA; Broach, Dana M., Civil Aeromedical Inst., USA; Thompson, Richard C., Civil Aeromedical Inst., USA; Enos, Robert J., Civil Aeromedical Inst., USA; October 1999; 22p; In English

Contract(s)/Grant(s): AM-B-98-HRR-172

Report No.(s): DOT/FAA/AM/99/24; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A low cost air traffic control (ATC) multi-sector training platform was developed to simulate radar-based air traffic control tasks. The purpose of the training device was to provide a vehicle for delivering ATC training on teamwork. However, before training could be delivered it was first necessary to develop training scenarios that would place participants under a specific amount of work. The results of the scenario calibration study reported in this paper suggest that the three scenarios can be viewed as representing low, medium, and high workload conditions based on the performance of 31 four-person teams. Statistically significant performance differences were observed across all three scenarios based on the percentage of aircraft that reached their destination within the allotted time, the amount of aircraft delay, the number of safety errors, and participants' perceptions of their workload.

Author

Air Traffic Control; Training Devices; Low Cost; Evaluation; Fabrication; Calibrating

19990110320 NASA Goddard Space Flight Center, Greenbelt, MD USA

GPS Ocean Reflection Experiment on Spartan 251

Garrison, James L., NASA Goddard Space Flight Center, USA; Russo, Angela, NASA Goddard Space Flight Center, USA; Mickler, Dave, Colorado Univ., USA; Armatys, Michael, Colorado Univ., USA; Ferebee, Melvin J., NASA Langley Research Center, USA; [1999]; 39p; In English; ION GPS 1999, 4 Sep. 1999, Nashville, TN, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

It has recently been demonstrated that the GPS signal which has reflected from the ocean surface contains useful geophysical data from which the sea surface wind speed and other parameters can be extracted. This can be used for remote sensing, similar to present day use of radar altimeters or scatterometers, but with significantly smaller instrumentation because of the utilization of the existing GPS broadcast signal for illumination. Several campaigns of aircraft experimentation have been completed demonstrating this technique and reflected GPS data has been reliably collected from 25 km altitude on a balloon. However, there has not yet been a demonstration that the reflected GPS signal can be detected from orbit with sufficient signal to noise ratio (SNR) to make useful remote sensing measurements. A technology demonstration experiment was planned for a Space Shuttle flight in the late 2000 using the Spartan 251 recoverable carrier. This experiment would also have been the first flight validation of the PiVoT GPS receiver developed in house at the Goddard Space Flight Center. The "open-architecture" design of this receiver would allow the software modifications to be made which control code-correlator spacing to map out the shape of the reflected signal waveform, which is the most basic data product generated by this instrumentation. A moderate gain left-hand circularly polarized antenna, constructed from an array of off-the-shelf hemispherical antennas was to be used to give approximately 3 to 6 dB of additional gain. Preliminary SNR predictions have been done indicating that this antenna would offer sufficient gain to record waveform measurements. A system level description of the experiment instrumentation, including the receiver, antenna and data storage and retrieval will be given. The visibility of GPS reflections over the mission duration of several hours will be studied, including the effects of the limited beamwidth of the antenna. Spartan 251 has now been postponed with the earliest opportunity in the year 2002. The results of this study however, have been 2 used to further the define the requirements and expected performance of reflected GPS receivers in orbit. Several other space flight opportunities are being considered based upon this new information.

Author

Global Positioning System; Wind Velocity; Waveforms; Remote Sensing; Ocean Surface; Data Storage

19990111573 NASA Pasadena Office, CA USA

Methods and Apparatus for Reducing Multipath Signal Error Using Deconvolution

Kumar, Rajendra, Inventor, Jet Propulsion Lab., California Inst. of Tech., USA; Lau, Kenneth H., Inventor, Jet Propulsion Lab., California Inst. of Tech., USA; Jun. 29, 1999; In English

Patent Info.: Filed 16 Jan. 1997; NASA-Case-NPO-19602-1-CU; US-Patent-5,918,161; US-Patent-Appl-SN-786356; No Copyright; Avail: US Patent and Trademark Office, Hardcopy

A deconvolution approach to adaptive signal processing has been applied to the elimination of signal multipath errors as embodied in one preferred embodiment in a global positioning system receiver. The method and receiver of the present invention estimates then compensates for multipath effects in a comprehensive manner. Application of deconvolution, along with other adaptive identification and estimation techniques, results in completely novel GPS (Global Positioning System) receiver architecture.

Author

Signal Processing; Errors; Multipath Transmission

19990111743 NASA Langley Research Center, Hampton, VA USA

Investigation of Measurement Errors in Doppler Global Velocimetry

Meyers, James F., NASA Langley Research Center, USA; Lee, Joseph W., NASA Langley Research Center, USA; 1999; 14p; In English; World Aviation Congress and Exposition, 19-21 Oct. 1999, San Francisco, CA, USA; Sponsored by Society of Automotive Engineers, Inc., USA

Report No.(s): SAE-1999-01-5599; Copyright; Avail: Issuing Activity, Hardcopy

While the initial development phase of Doppler Global Velocimetry (DGV) has been successfully completed, there remains a critical next phase to be conducted, namely the determination of an error budget to provide quantitative bounds for measurements obtained by this technology. This paper describes a laboratory investigation that consisted of a detailed interrogation of potential error sources to determine their contribution to the overall DGV error budget. A few sources of error were obvious; e.g., Iodine vapor absorption lines, optical systems, and camera characteristics. However, additional non-obvious sources were also discovered; e.g., laser frequency and single-frequency stability, media scattering characteristics, and interference fringes. This paper describes each identified error source, its effect on the overall error budget, and where possible, corrective procedures to reduce or eliminate its effect.

Author

Error Analysis; Instrument Errors; Velocity Measurement

19990114887 Federal Aviation Administration, Technical Center, Atlantic City, NJ USA

Air Traffic Control System Baseline Methodology Guide

Allendoerfer, Kenneth R.; Galushka, Joseph; Jun. 1999; 88p; In English

Report No.(s): AD-A367892; DOT/FAA/CT-TN99/15; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The Air Traffic Control System Baseline Methodology Guide serves as a reference in the design and conduct of baseline studies. Engineering research psychologists are the intended audience for the Methodology Guide, which focuses primarily on techniques for studying the interaction between ATC systems and the controllers who use them. The Methodology Guide provides the following information: (a) descriptions of and references to past baselines that have successfully used the methodology, (b) detailed descriptions of the baseline operational constructs and corresponding objective and subjective measures, (c) a description of the overall baseline methodology, (d) other recommendations and lessons learned regarding the successful conduct of system baselines, and (e) a discussion of the role of system baselines in the ATC system acquisition process.

DTIC

Methodology; Management Information Systems; Air Traffic Control

19990115884 National Aerospace Lab., Structures Div., Tokyo, Japan

Confirmation Tests of ALFLEX Vibration Characteristics

Kanda, A.; Sotozaki, T.; Ueda, T.; Dec. 1998; 26p; In Japanese; Portions of this document are not fully legible

Report No.(s): PB99-164972; NAL-TR-1370; Copyright; Avail: National Technical Information Service (NTIS), Hardcopy

Ground vibration tests of ALFLEX were carried out by using the Dynamic Displacement Measurement System which enables automatic data acquisition. After structural improvements and flight experiments, vibration characteristics of ALFLEX were

confirmed by ground tests. Modal measurements for local vibrations were also conducted by the hammer-impact method. The vibration problem that occurred in the pitch rate of IMU (Inertial Measurement Unit) the flight experiments was considered.
NTIS
Vibration Tests; Displacement Measurement; Automatic Landing Control; Structural Vibration

19990115909 Federal Aviation Administration, Cambridge, MA USA
Guidelines for the Use of Color in ATC Displays *Final Report*
Cardosi, Kim, Federal Aviation Administration, USA; Hannon, Dan, Federal Aviation Administration, USA; Jun. 1999; 60p; In English
Contract(s)/Grant(s): FA9L1/A9112
Report No.(s): AD-A367984; DOT-VNTSC-FAA-98-5; DOT/FAA/AR-99/52; No Copyright; Avail: CASI; A01, Microfiche; A04, Hardcopy

Color is probably the most effective, compelling, and attractive method available for coding visual information on a display. However, caution must be used in the application of color to displays for air traffic control (ATC), because it is easy to do more harm than good. The only thing that is truly obvious about the use of color on displays is that its benefits and drawbacks depend upon the task. This paper offers general guidelines on how color should, and should not, be used, but does not define a specific color-coding scheme. These guidelines are based on what is known about human vision, display capabilities, the knowledge gained from the lessons learned from the uses of color in the cockpit and ATC environments, and human factors "best practices." The report also discusses a series of experiments that examined color production capabilities within and across five Sony DDM-2801C monitors and selected and validated an "ideal" color set for this monitor.
DTIC
Visual Perception; Monitors; Air Traffic Control; Color Coding; Human Performance

19990116761 European Organization for the Safety of Air Navigation, Brussels, Belgium
Air Traffic Management Capacity Constraints on and Around Airports
Griffin, F. E. Martin, European Organization for the Safety of Air Navigation, Belgium; The Potential of Rotocraft to Increase Airport Capacity: Proceedings; 1999, pp. 9.1 - 9.5; In English; See also 19990116754; Copyright; Avail: Issuing Activity, Hardcopy

The European Organisation for the Safety of Air Navigation (EUROCONTROL) is moving into a new era. Originally established as an en-route organisation, the recently agreed 'ATM Strategy for 2000+' widens its scope of activity to provide for a 'Gate to Gate' approach. For the first time this includes airport activities into the EUROCONTROL mandate. Many EUROCONTROL initiatives have already been successful in increasing capacity in the en-route environment. However it is arguable that the biggest challenges have yet to be met in the form of airports and terminal airspace. Airport congestion, already a problem at many major airports, is likely to become an even more serious constraint. Runway availability may be perceived as the ultimate constraining factor. However, there is a need to understand the underlying reasons for a wider set of constraints on and around airports, by understanding the causal factors of constraints, actions may be focused oil initiatives to mitigate against their effect. These actions will necessitate the use of advanced technology. Notwithstanding the fact that a number of reports have investigated the use of rotorcraft, as yet, their use to enhance air traffic capacity on and around airports has not been considered to a large degree. This paper considers the potential use of rotorcraft to overcome constraints in the vicinity of airports. Existing operational practices are examined and the need for change, where necessary, considered.
Author
Air Traffic Control; Rotary Wing Aircraft; Airports; Air Navigation

19990116762 Boeing Co., Advanced Rotorcraft Systems, Philadelphia, PA USA
Integrated Rotorcraft/Vertical Flight Operations to Reduce Delay and Increase Capacity
Wilkins, Robert Ryan, Jr., Boeing Co., USA; The Potential of Rotocraft to Increase Airport Capacity: Proceedings; 1999, pp. 10.1 - 10.16; In English; See also 19990116754; Copyright; Avail: Issuing Activity, Hardcopy

U.S. and international airspace problems continue to multiply daily... Passenger demand has grown at an unprecendented rate, at much better than the expected 4%, to a high of 6-8%. As passenger demands increase so does the demand for access to already constrained terminal airspace. However, the problem is not so much the airspace as it is the terminal facility, specifically at the runway. A traditional airport's capacity is dependent on the most limiting component, namely the runway system. WHY? Competition for already scarce runway occupancy time is growing and, in many cases, is being limited by environmental concerns." Even with the implementation of ATM tools as the US' Center-TRACON Automation Tool (CTAS), EUROCONTROL's Central Flow Management Unit (CFMU) and IATA's Schedule Coordination Services (SCS), the analogy

often heard considering the "Free Flight" concept is like trying to funnel an eight lane highway into a one car garage. Aircraft mix, numbers of different types of aircraft with their different seating capacities and disparate inherent performance characteristics, requires separate solutions to spacing and traffic management especially in increasingly congested terminal airspace. There are no more easy solutions like "build more runways." Where? Cooperative but separate operations (similar to the 1998 Gulf of Mexico GPS Grid System) must also be established in the enroute sectors, such as the Northeast Corridor low-level routes between Boston, Massachusetts and Washington, DC, or within the SanFrancisco-Los Angeles-San Diego corridor permitting Required Navigation Performance (RNP)-based IFR IMC operations at less then 10,000 feet MSL. This will also require positive Communications Navigation and Surveillance /Air Traffic Management (CNS/ATM) below 6000 feet. New, innovative solutions must be developed, explored and implemented. A new paradigm must be established and implemented. We can not afford the luxury of waiting for the aviation gridlock to happen. Mr. Neil Kinnock, EU Transport Commissioner said that "The market is developing so fast that we need to develop now a strategy for the future." Solutions? Consider two concepts. First, new aircraft types such as the tiltrotor, a high performance turboprop with its unique capability to takeoff and land vertically if needed, or improved large, efficient, cost-effective helicopters. Second, an already proven concept of airspace management using simultaneous, converging instrument approaches (SCIA), Lateral Navigation Required Navigation Performance (LNAV RNP) routes and separate final approach and takeoff areas (FATO's) appropriately named Simultaneous and Non-Intertering or SNI. The combination of these has tremendous potential to alleviate existing and future delays and to provide for increased capacity. Author

Rotary Wing Aircraft; Vertical Flight; Airports; Airspace; Flight Operations; Instrument Approach

19990116980 Federal Aviation Administration, John A. Volpe National Transportation Systems Center, Cambridge, MA USA

Guidelines for the Use of Color in ATC Displays *Final Report*

Cardosi, Kim; Harmon, Dan; Jun. 1999; 60p; In English

Report No.(s): AD-A368697; DOT-VNTSC-FAA-98-5; DOT/FAA-AR-99/52; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Color is probably the most effective, compelling, and attractive method available for coding visual information on a display. However, caution must be used in the application of color to displays for air traffic control (ATC), because it is easy to do more harm than good. The only thing that is truly obvious about the use of color on displays is that its benefits and drawbacks depend upon the task. This paper offers general guidelines on how color should, and should not, be used, but does not define a specific color coding scheme. These guidelines are based on what is known about human vision, display capabilities, the knowledge gained from the lessons learned from the uses of color in the cockpit and ATC environments, and human factors best practices. The report also discusses a series of experiments that examined color production capabilities within and across five Sony DDM-28010 monitors and selected and validated an ideal color set for this monitor.

DTIC

Human Factors Engineering; Color Coding; Air Traffic Control

19990117043 General Accounting Office, Resources, Community and Economic Development Div., Washington, DC USA

Air Traffic Control: Status of FAA's Implementation of the Display System Replacement Project

Oct. 11, 1999; 14p; In English; Testimony Before the Subcommittee on Aviation, Committee on Transportation and Infrastructure, House of Representatives.

Report No.(s): AD-A369658; GAO/T-RCED-00-19; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We appreciate the opportunity to provide our observations on the status of the Federal Aviation Administration's (FAA) implementation of the Display System Replacement (DSR) project. DSR, which replaces the controllers' workstations and other equipment in the nation's en route centers, is one of FAA's major projects under the air traffic control modernization program. In 1981, FAA began a multibillion-dollar modernization effort to improve the safety, the capacity, and the efficiency of this system to meet the increasing demand for air traffic services and to replace aging equipment. The agency plans to spend approximately $41 billion on the modernization effort from fiscal years 1982 through 2004. FAA has historically experienced some major difficulties in delivering modernization projects within cost, schedule, and performance parameters However, over the past couple of years, FAA has taken steps to improve its management of the modernization program. In particular, the agency has revised its approach to acquiring new systems by limiting their scope to manageable segments. Continuing with its new approach to modernization is key to allowing FAA to consistently deliver new systems within established goals. In this context, you asked us to address (1) the status of FAA's overall modernization program, (2) FAA's progress in implementing DSR, with particular emphasis on events surrounding Boston's implementation, and (3) opportunities for continued success by FAA in completing its

modernization projects. GAO has a long history of reviewing the modernization program as well as individual projects, and this testimony is based on prior reports and testimonies.
DTIC
Display Devices; Replacing; Safety; Air Traffic Control; Aging (Biology)

19990117184 Naval Postgraduate School, Monterey, CA USA
Improvements in Dynamic GPS Positions Using Track Averaging, *1 Feb. 1998 - 30 Sep. 1999*
Clynch, James R., Naval Postgraduate School, USA; Franke, Richard, Naval Postgraduate School, USA; Neta, Beny, Naval Postgraduate School, USA; Aug. 1999; 40p; In English
Contract(s)/Grant(s): MIRPST98894D19
Report No.(s): AD-A369222; NPS-MA-99-004; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

The issue of improving a Global Positioning System (GPS), Precise Positioning System (PPS) solution under dynamic conditions through averaging is investigated. Static and dynamic data from the Precision Lightweight GPS Receiver (PLGR) were used to analyze the error characteristics and design an averaging technique for dynamic conditions. It was found that the errors in PPS solutions are dominated by the satellite broadcast ephemeris parameters. The solution errors are highly correlated for a given set of satellites/ephemeris. The variation can be as low as 0.4 m in dynamic conditions, but a slowly changing "bias" of several meters is also present. For fitting the location of a road observed repeatedly with a PPS receiver a technique based on "space curves" was developed. Here the solutions are transformed from functions of time to functions of space (location). These then are used. Curves could be fit with a Bezier polynomial easily to the 0.4 m level. These analytic curves were then used to form an ensemble average. The bias vectors between the solutions were found with least squares estimation. These vectors were averaged using several techniques. This idea was applied to a short road segment. Using 9 independent measurements taken over 6 months, the road was surveyed at the submeter level.
DTIC
Global Positioning System; Broadcasting; Polynomials

05
AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology

19990061875 NASA Langley Research Center, Hampton, VA USA
Flight Test of Optimal Inputs and Comparison with Conventional Inputs
Morelli, Eugene A., NASA Langley Research Center, USA; Journal of Aircraft; April 1999; Volume 36, No. 2, pp. 389-397; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

A technique for designing optimal inputs for aerodynamic parameter estimation was flight tested on the F-18 High Alpha Research Vehicle. Model parameter accuracies calculated from flight-test data were compared on an equal basis for optimal input designs and conventional inputs at the same flight condition. In spite of errors in the a priori input design models and distortions of the input forms by the feedback control system, analysis of data generated by the optimal inputs revealed lower estimated parameter errors compared with conventional 3-2-1-1 and doublet inputs. In addition, the tests using optimal input designs demonstrated enhanced design flexibility, allowing the optimal input design technique to use a larger input amplitude to achieve further increases in estimated parameter accuracy without departing from the desired flight-test condition. This work validated the analysis used to develop the optimal input designs, and demonstrated the feasibility and effectiveness of the optimal input design technique.
Author
F-18 Aircraft; Flight Tests; Parameter Identification; Mathematical Models; Flight Optimization; Aircraft Maneuvers; Flight Characteristics

19990061883 NASA Dryden Flight Research Center, Edwards, CA USA
Design Challenges Encountered in a Propulsion-Controlled Aircraft Flight Test Program
Maine, Trindel, NASA Dryden Flight Research Center, USA; Burken, John, NASA Dryden Flight Research Center, USA; Burcham, Frank, NASA Dryden Flight Research Center, USA; Schaefer, Peter, University of Southern California, USA; 1994; 18p; In English; Joint Propulsion, 27-29 Jun. 1994, Indianapolis, IN, USA; Sponsored by American Inst. for Research, USA
Contract(s)/Grant(s): RTOP 505-68-33
Report No.(s): AIAA Paper 94-3359; Copyright; Avail: Issuing Activity, Hardcopy

The NASA Dryden Flight Research Center conducted flight tests of a propulsion-controlled aircraft system on an F-15 airplane. This system was designed to explore the feasibility of providing safe emergency landing capability using only the engines to provide flight control in the event of a catastrophic loss of conventional flight controls. Control laws were designed to control the flightpath and bank angle using only commands to the throttles. Although the program was highly successful, this paper highlights some of the challenges associated with using engine thrust as a control effector. These challenges include slow engine response time, poorly modeled nonlinear engine dynamics, unmodeled inlet-airframe interactions, and difficulties with ground effect and gust rejection. Flight and simulation data illustrate these difficulties.

Author

Flight Tests; Flight Control; Aircraft Landing; Thrust Control; Throttling; Control Systems Design; Flight Paths; Turning Flight

19990061938 Boeing Commercial Airplane Co., Seattle, WA USA

Study of the Application of Separation Control by Unsteady Excitation to Civil Transport Aircraft

McLean, J. D., Boeing Commercial Airplane Co., USA; Crouch, J. D., Boeing Commercial Airplane Co., USA; Stoner, R. C., Boeing Commercial Airplane Co., USA; Sakurai, S., Boeing Commercial Airplane Co., USA; Seidel, G. E., Boeing Commercial Airplane Co., USA; Feifel, W. M., Boeing Commercial Airplane Co., USA; Rush, H. M., Boeing Commercial Airplane Co., USA; June 1999; 64p; In English

Contract(s)/Grant(s): NAS1-20267; RTOP 522-32-31-01

Report No.(s): NASA/CR-1999-209338; NAS 1.26:209338; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This study provides a preliminary assessment of the potential benefits of applying unsteady separation control to transport aircraft. Estimates are given for some of the costs associated with a specific application to high-lift systems. High-leverage areas for future research were identified during the course of the study. The study was conducted in three phases. Phase 1 consisted of a coarse screening of potential applications within the aerodynamics discipline. Potential benefits were identified and in some cases quantified in a preliminary way. Phase 2 concentrated on the application to the wing high-lift system, deemed to have the greatest potential benefit for commercial transports. A team of experts, including other disciplines (i.e. hydraulic, mechanical, and electrical systems, structures, configurations, manufacturing, and finance), assessed the feasibility, benefits, and costs to arrive at estimates of net benefits. In both phases of the study, areas of concern and areas for future research were identified. In phase 3 of this study, the high-leverage areas for future research were prioritized as a guide for future efforts aimed at the application of active flow control to commercial transport aircraft.

Author

Transport Aircraft; Active Control; Commercial Aircraft; Separated Flow; Feasibility Analysis; Aircraft Control

19990110584 NASA Dryden Flight Research Center, Edwards, CA USA

Design Challenges Encountered in a Propulsion-Controlled Aircraft Flight Test Program

Maine, Trindel, NASA Dryden Flight Research Center, USA; Burken, John, NASA Dryden Flight Research Center, USA; Burcham, Frank, NASA Dryden Flight Research Center, USA; Schaefer, Peter, University of Southern California, USA; June 1994; 19p; In English; 30th; Joint Propulsion, 27-29 Jun. 1994, Indianapolis, IN, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): RTOP 505-68-33

Report No.(s): H-2000; AIAA Paper 94-3359; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

The NASA Dryden Flight Research Center conducted flight tests of a propulsion-controlled aircraft system on an F-15 airplane. This system was designed to explore the feasibility of providing safe emergency landing capability using only the engines to provide flight control in the event of a catastrophic loss of conventional flight controls. Control laws were designed to control the flightpath and bank angle using only commands to the throttles. Although the program was highly successful, this paper highlights some of the challenges associated with using engine thrust as a control effector. These challenges include slow engine response time, poorly modeled nonlinear engine dynamics, unmodeled inlet-airframe interactions, and difficulties with ground effect and gust rejection. Flight and simulation data illustrate these difficulties.

Author

Flight Tests; Design Analysis; Propulsion; Flight Control; Control Equipment; Ground Effect (Aerodynamics); Simulation; Thrust

19990110637 McDonnell-Douglas Aerospace, Long Beach, CA USA

Suppressor Nozzle Impact on Aircraft Performance and Design

Mortlock, Alan K., McDonnell-Douglas Aerospace, USA; First NASA/Industry High Speed Research Program Nozzle Symposium; September 1999, pp. 32-1 - 32-7; In English; See also 19990110605; No Copyright; Avail: CASI; A02, Hardcopy;

A10, Microfiche

The exhaust nozzle performance of the HSCT engine is an extremely sensitive design parameter for determining the aircraft size to perform to a mission requirement. The acoustic and thrust performance required during takeoff and climb can determine engine size and consequently effect overall aircraft mission performance. During supersonic cruise the noise suppression devices must be stowed in a manner to prevent leakage or blockage in order to achieve the best efficient nozzle conditions.

Author

Sensitivity; Noise Reduction; Design Analysis; Acoustic Properties

19990110676 NASA Dryden Flight Research Center, Edwards, CA USA

A Flying Qualities Study of Longitudinal Long-Term Dynamics of Hypersonic Planes

Cox, Timothy H., NASA Dryden Flight Research Center, USA; Sachs, G., Technische Univ., Germany; Knoll, A., Technische Univ., Germany; Stich, R., Technische Univ., Germany; 19950401; 26p; In English; 6th; International Aerospace Planes and Hypersonics Technologies, 3-7 Apr. 1995, Chattanooga, TN, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): RTOP 466-70-64

Report No.(s): NASA/TM-1999-104308; NAS 1.15:104308; H-2034; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The NASA Dryden Flight Research Center and the Technical University of Munich are cooperating in a research program to assess the impact of unstable long-term dynamics on the flying qualities of planes in hypersonic flight. These flying qualities issues are being investigated with a dedicated flight simulator for hypersonic vehicles located at NASA Dryden. Several NASA research pilots have flown the simulator through well defined steady-level turns with varying phugoid and height mode instabilities. The data collected include Pilot ratings and comments, performance measurements, and Pilot workload measurements. The results presented in this paper include design guidelines for height and Phugoid mode instabilities, an evaluation of the tapping method used to measure pilot workload, a discussion of techniques developed by the pilots to control large instabilities, and a discussion of how flying qualities of unstable long-term dynamics influence control Power design requirements.

Author

Flight Characteristics; Hypersonic Aircraft; Oscillations; Longitudinal Stability; Aircraft Stability; Controllability; Longitudinal Control; Flight Simulation

19990111717 California Univ., School of Engineering and Applied Science, Los Angeles, CA USA

Characterization of Materials Degradation due to Corrosion and Fatigue in Aerospace Structures *Final Report, 15 Apr. 1993 - 14 Oct. 1998*

Mai, A. K.; Yang, J. M.; Ono, K.; May 13, 1999; 17p; In English

Contract(s)/Grant(s): F49620-93-1-0320; AF Proj. 3484

Report No.(s): AD-A364745; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Research was carried out in two related areas: (1) the degradation in the load carrying capacity of the structural components, and (2) nondestructive evaluation (NDE) for characterization of the degradation. In the first topic, the effect of pitting corrosion on the strength of aircraft grade aluminum alloys was studied through laboratory tensile and fatigue tests and theoretical modeling. The probability of failure in the presence of multiple pits was found to be strongly affected by certain parameters of the pit distribution. The effect of fatigue and dynamic loading on structural (polymer matrix as well as metal matrix) composites was also studied both theoretically and experimentally. Certain metal matrix composites were found to perform poorly under transverse loads due to stress concentration effects at fiber-matrix debond edges and at microcracks within the interfacial layers. In the second topic, four relatively new ultrasonic NDE techniques were developed. In the first, a guided wave based technique for detecting hidden corrosion sites in aluminum lap joints was developed. This technique has the potential to improve the effectiveness and efficiency of lap joint inspection significantly. Another technique based on a dual transducer pitch-catch arrangement was developed that can be used for cost-effective characterization of composite laminates. A third technique based on dual contact transducers was introduced for the monitoring of the stiffness degradation of composites during fatigue loading. In the fourth technique a guided wave based acoustic emission method was developed for monitoring micro crack growth from corrosion sites in aluminum and from impact load sites in composites. This technique has the potential for use in detecting the presence of hidden corrosion sites at an early stage of their development in metallic aircraft structures and to monitor impact damage in composite aircraft structures.

DTIC

Composite Materials; Composite Structures; Fatigue Tests

19990113114 Army Research Lab., Hampton, VA USA
Evaluation of the Grasshopper Unmanned Aerial Vehicle *Final Report*
Wilbur, Matthew L., Army Research Lab., USA; October 1999; 20p; In English
Contract(s)/Grant(s): 62211/A47B
Report No.(s): VTD-NR-99-05; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report details the evaluation of small-scale UAV to benefit United States military forces: The future may prove that a Grasshopper-class vehicle like this one is an excellent platform for reconnaissance and surveillance. However, the feasibility of such a UAV powered by off-the-shelf brushless electric motors and controllers typically used in 'hobby-class' vehicles is minimal at this time due to the technology status of the motors, controllers, and batteries. The motors and the motor controllers utilized during this test program were incapable of converting enough electrical power to generate sufficient thrust to lift a 10 lb vehicle. Based on the results of this program it is clear that if a motor and propeller were identified that could generate sufficient thrust, the battery weight required to drive the system would easily exceed the gross weight of the vehicle. Based on the results of this test effort the following conclusions have been reached: 1) The out-of-ground effect flight condition is the design driver of a Grasshopper-class flight vehicle. A UAV with sufficient thrust to operate out-of-ground effect will easily support in-ground effect flight. 2) The propeller/duct design of this baseline Grasshopper design does not provide an increase in thrust production over that generated by an unducted propeller. Further development of this vehicle will require careful attention to the propeller duct coupling effect. 3) A maximum out-of-ground effect thrust o approximately 1.9 lb is attainable using current technology brushless electric motor/controller systems. This appears to be the upper limit regardless of the propeller design used. 4) The maximum thrust-per-power value, a measure of the efficiency of a motor and propeller is nearly the same regardless of the propeller design used. 5) The primary contributor to poor thrust capability is the lack of sufficient power delivery and/or rotational speed to the propeller -- affected primarily by the motor/controller characteristics.
Author

Evaluation; Pilotless Aircraft; Surveillance; Flight Conditions; Flight Tests

19990114304 Naval Postgraduate School, Monterey, CA USA
Nonlinear Dynamics in the Modeling of Helicopter Rotor Blade Lead/Lag Motion
King, Robert L.; Jun. 1999; 176p; In English
Report No.(s): AD-A366866; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

Until recently, computer simulations of helicopter rotor dynamics have employed equations of motion that have been linearized or simplified. These modified equations of motion did not allow for the evaluation of nonlinear material properties in the rotor since higher order terms in the dynamics had been modified in the simplification process. With recent advances in both computer simulation hardware and symbolic mathematic manipulation software, the full nonlinear equations of motion may be utilized in helicopter rotor simulations. This dissertation reports on the use of the full nonlinear equations of motion in the analysis of rotor blade lead/lag motion and its effect on rotor hub and rigid body fuselage motion. Nonlinear modeling methods are implemented using Maple symbolic mathematic manipulation software and Matlab and Simulink computer simulation environments. Results are compared to the RAH-66 Comanche Froude scale wind tunnel article and new methodologies evaluated in the search for a damperless rotor system that is free of ground and air resonance mechanical instabilities.
DTIC

Computerized Simulation; Equations of Motion; Ground Resonance; Motion Simulation; Rotary Wings

19990114877 General Accounting Office, National Security and International Affairs Div., Washington, DC USA
DEFENSE ACQUISITIONS: Comanche Program Cost, Schedule, and Performance Status
Aug. 1999; 21p; In English; Report to the Honorable Peter A. DeFazio, House of Representatives.
Report No.(s): AD-A368029; GAO/NSIAD-99-146; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Comanche's restructured program contains significant risks' of cost overruns, schedule delays, and degraded performance because it would (1) begin file engineering and manufacturing development phase before some key mission equipment technologies have matured and have been integrated into the flight-test aircraft; (2) compress the flight-test schedule, increasing file amount of concurrent developmental and operational testing; and (3) begin initial production before initial operational testing starts, resulting in concurrency between development testing and initial production. The program is proceeding to the next development phase with high levels of uncertainty.
DTIC

Attack Aircraft; Military Technology

19990114919 Ohio State Univ., Columbus, OH USA

A Tethered Heavier-Than-Air Vehicle for Atmospheric Sounding

LaRue, Robert D., Ohio State Univ., USA; Proceedings: AFCRL Tethered Balloon Workshop, 1967; 1967, pp. 197-205; In English; See also 19990114900; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

This paper describes the instrument carrying system developed by the Atmospheric Science Department of Colorado State University under the direction of Professor Lewis O. Grant. The author participated in this project both as a member of the Mechanical Engineering Department faculty of Colorado State University and during summers since his affiliation with Ohio State University.

Author

Tethered Balloons; Meteorological Balloons; Atmospheric Sounding; Balloon Sounding; Superpressure Balloons

19990114996 Naval Air Warfare Center, Aircraft Div., Patuxent River, MD USA

Evolution of the Teaming Concept in Naval Aviaiton Flight Test

Jul. 19, 1999; 9p; In English

Report No.(s): AD-A367689; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Flight test in Patuxent River is making positive and dramatic moves to incorporate the team concept into all flight test programs. "Up front and early" has replaced kick it over the fence" as the basic flight test philosophy. In a world where tradeoffs between cost, schedule, and performance drive the entire acquisition process, the team concept is gaining strength. The product continues to be better and better as potential problems are averted on many programs earlier and earlier. Early problem identification and resolution are saving millions of dollars, and are enabling a much higher mission performance and safer aircraft for the flight test program and the end fleet user. There are still many challenges ahead. Teaming is an evolutionary concept whose time has come, but the evolution is not complete. A few more years are required to institutionalize the changes developed over the last decade. While the fleet continues to press crew concept, CRM/ACT, and teaming throughout the various communities, teaming has certainly found a home in Navy flight test and indeed the entire acquisition community. With continued reductions l programmatic cost and schedule, and increases in system safety and performance that teaming brings to the table, it is definitely here to stay.

DTIC

Navy; Flight Tests

19990115466 NASA Langley Research Center, Hampton, VA USA

Hyper-X Stage Seperation: Background and Status

Reubush, David E., NASA Langley Research Center, USA; [1999]; 16p; In English; 9th; International Space Planes and Hypersonic Systems and Technologies conference, 1-5 Nov. 1999, Norfolk, VA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): AIAA Paper 99-4818; Copyright Waived; Avail: Issuing Activity, Hardcopy

This paper provides an overview of stage separation activities for NASA's Hyper-X program; a focused hypersonic technology effort designed to move hypersonic, airbreathing vehicle technology from the laboratory environment to the flight environment. This paper presents an account of the development of the current stage separation concept, highlights of wind tunnel experiments and computational fluid dynamics investigations being conducted to define the separation event, results from ground tests of separation hardware, schedule and status. Substantial work has been completed toward reducing the risk associated with stage separation.

Author

Stage Separation; Rocket Vehicles; Hypersonic Vehicles; Air Breathing Engines

19990115788 Wichita State Univ., Wichita, KS USA

Review of Damage Tolerance for Composite Sandwich Airframe Structures *Final Report*

Tomblin, J.; Lacy, T.; Smith, B.; Hooper, S.; Vizzini, A.; Aug. 1999; 78p; In English

Report No.(s): PB99-172710; DOT/FAA/AR-99/49; No Copyright; Avail: CASI; A01, Microfiche; A05, Hardcopy

The use of composite sandwich construction is rapidly increasing in current and future airframe designs especially for general aviation aircraft and rotorcraft. Typically, sandwich constructions for these applications use thin-gage composite face sheets (0.020 in to 0.045 in) which are cocured to honeycomb and foam cores. Due to the nature of these structures, damage tolerance is more complex than conventional laminated structures. Besides typical damage concerns such as through penetration and delamination, additional modes including core crushing and facesheet debonding must also be addressed. This complicates the certification process by introducing undefined Allowable Damage Limits (ADL) and Critical Damage Thresholds (CDT) as

related to the ultimate and limit load carrying capability of the structure. This document provides a background review of previous damage tolerance investigations including an overview of traditional metallic damage tolerance methodologies.
NTIS
Damage; Tolerances (Mechanics); Composite Structures; Sandwich Structures; Aircraft Construction Materials

19990115821 NASA Langley Research Center, Hampton, VA USA
Airbreathing Hypersonic Technology Vision Vehicles and Development Dreams
McClinton, C. R., NASA Langley Research Center, USA; Hunt, J. L., NASA Langley Research Center, USA; Ricketts, R. H., NASA Langley Research Center, USA; Reukauf, P., NASA Dryden Flight Research Center, USA; Peddie, C. L., NASA Glenn Research Center, USA; [1999]; 20p; In English; 9th; 3rd; International Space Planes and Hypersonic Systems and Technologies Conference, 1-5 Nov. 1999, Norfolk, VA, Norfolk, VA, USA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Original contains color illustrations
Report No.(s): AIAA Paper 99-4978; Copyright Waived; Avail: Issuing Activity, Hardcopy

Significant advancements in hypersonic airbreathing vehicle technology have been made in the countries research centers and industry over the past 40 years. Some of that technology is being validated with the X-43 flight tests. This paper presents an overview of hypersonic airbreathing technology status within the US, and a hypersonic technology development plan. This plan builds on the nation's large investment in hypersonics. This affordable, incremental plan focuses technology development on hypersonic systems, which could be operating by the 2020's.
Author
Air Breathing Engines; Hypersonic Flight; X-43 Vehicle; Aerothermodynamics

19990115885 NASA Langley Research Center, Hampton, VA USA
Propulsion System Airframe Integration Issues and Aerodynamic Database Development for the Hyper-X Flight Research Vehicle
Engelund, Walter C., NASA Langley Research Center, USA; Holland, Scott D., NASA Langley Research Center, USA; Cockrell, Charles E., Jr., NASA Langley Research Center, USA; 1999; 12p; In English; 15th; ISOABE, 5-10 Sep. 1999, Florence, Italy
Report No.(s): ISOABE-99-7215; Copyright; Avail: Issuing Activity, Hardcopy

NASA's Hyper-X Research Vehicle will provide a unique opportunity to obtain data on an operational airframe integrated scramjet propulsion system at true flight conditions. The airframe integrated nature of the scramjet engine with the Hyper-X vehicle results in a strong coupling effect between the propulsion system operation and the airframe's basic aerodynamic characteristics. Comments on general airframe integrated scramjet propulsion system effects on vehicle aerodynamic performance, stability, and control are provided, followed by examples specific to the Hyper-X research vehicle. An overview is provided of the current activities associated with the development of the Hyper-X aerodynamic database, including wind tunnel test activities and parallel CFD analysis efforts. A brief summary of the Hyper-X aerodynamic characteristics is provided, including the direct and indirect effects of the airframe integrated scramjet propulsion system operation on the basic airframe stability and control characteristics.
Author
Aerodynamic Characteristics; Airframes; Propulsion System Configurations; Research Vehicles; Supersonic Combustion Ramjet Engines; Wind Tunnel Tests; Computational Fluid Dynamics

19990115886 NASA Langley Research Center, Hampton, VA USA
Deformation Measurements of Smart Aerodynamic Surface
Fleming, Gary A., NASA Langley Research Center, USA; Burner, Alpheus W., NASA Langley Research Center, USA; 1999; 12p; In English; 44th; Optical Science, Engineering, and Instrumentation: Optical Diagnostics for Fluids/Heat/Combustion and Photomechanics for Solids, 18-23 Jul. 1999, Denver, CO, USA; Sponsored by International Society for Optical Engineering
Report No.(s): SPIE Paper 3783-25; No Copyright; Avail: Issuing Activity, Hardcopy

Video Model Deformation (VMD) and Projection Moire Interferometry (PMI) were used to acquire wind tunnel model deformation measurements of the Northrop Grumman-built Smart Wing tested in the NASA Langley Transonic Dynamics Tunnel. The F18-E/F planform Smart Wing was outfitted with embedded shape memory alloys to actuate a seamless trailing edge aileron and flap, and an embedded torque tube to generate wing twist. The VMD system was used to obtain highly accurate deformation measurements at three spanwise locations along the main body of the wing, and at spanwise locations on the flap and aileron. The PMI system was used to obtain full-field wing shape and deformation measurements over the entire wing lower surface. Although less accurate than the VMD system, the PMI system revealed deformations occurring between VMD target

rows indistinguishable by VMD. This paper presents the VMD and PMI techniques and discusses their application in the Smart Wing test.
Author
Aerodynamics; Deformation; Planforms; Shape Memory Alloys; Wind Tunnel Tests; Mission Adaptive Wings; Aeroelastic Research Wings; Smart Materials; Smart Structures

19990115904 Naval Air Warfare Center, Aircraft Div., Patuxent River, MD USA
The ACETEF HLA Interface for JADS-EW
Aug. 03, 1999; 8p; In English
Report No.(s): AD-A367655; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This paper presents the software approach taken at ACETEF to support the JADS-EW test. It begins by describing the overall structure of the JADS-EW federation and the roles played by the federates. The HLA interface consisted of two major components, namely the RTI Interface and the SWET Interface, designed to work together but separately, in order to decrease the workload of a single HLA interface. Though performing different functions, their general structure is similar in that each is guided by a Federate Manager, which directs all activity according to the specifications of a particular federation. Another common feature between both interfaces is the utilization of the C++ class inheritance, virtual functions, and polymorphism capabilities, which greatly assist in producing highly maintainable and reusable code.
DTIC
C++ (Programming Language); Computer Programs; Electronic Warfare; Jamming

19990115910 Department of Defense, Office of the Inspector General, Arlington, VA USA
Hazardous Material Management for the C/KC-135 Stratotanker Aircraft
Jun. 04, 1999; 28p; In English
Contract(s)/Grant(s): Proj. 8AE-5037.01
Report No.(s): AD-A368013; IG/DOD-99-177; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

The C/KC-135 Stratotanker Aircraft (the C/KC-135) is an Air Force program that consists of Acquisition Category II and III modification programs. The principal mission of the C/KC-135 aircraft is aerial refueling of other aircraft. The Air Force acquired 808 stratotankers and other variants of the C/KC-135 aircraft, of which 548 stratotankers and 46 special-purpose variants are on active duty. The average age of the aircraft in the fleet is 39 years. The stratotankers are equipped with a flying boom for fuel transfer and a deck above the fuselage-mounted tanks for passengers and cargo. Eight Air Force major commands, the National Aeronautics and Space Administration, and three foreign militaries operate C/KC-135 aircraft. The Air Force plans to operate the stratotanker fleet until 2040 and estimates that the total life-cycle cost to continue the program until then will be about $76 billion.
DTIC
Tanker Aircraft; C-135 Aircraft; Life Cycle Costs

19990115928 Department of Defense, Office of the Inspector General, Arlington, VA USA
Acquisition of the SH-60R Light Airborne Multipurpose System Mark III Block II Upgrade
Feb. 02, 1999; 33p; In English
Contract(s)/Grant(s): Proj. 8AE-9012
Report No.(s): AD-A367480; RN-99-075; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

The Light Airborne Multipurpose System Mark III (SH-60B) is a computer-integrated, ship and helicopter weapon system that increases the effectiveness of surface combatants by serving as an extension of the sensor and attack systems of the ships to which it is assigned. The Block II Upgrade will greatly enhance helicopter performance in the primary mission areas of anti-submarine warfare and anti-surface warfare. Upon completion of the Block II Upgrade, the helicopter will receive the designation SH-60R. The system is in the engineering and manufacturing development phase of the acquisition process. The SH-60B program office plans to award the low-rate initial production contract for the Block II Upgrade in FY 2000.
DTIC
Acquisition; Helicopter Performance; Light Airborne Multipurpose System; Weapon System Management

19990115930 Prins Maurits Lab. TNO, Rijswijk Netherlands
Fragment Penetration in Composite Plates *Final Report*
vanMeerten, E., Prins Maurits Lab. TNO, Netherlands; vanDoup, P. W., Prins Maurits Lab. TNO, Netherlands; Jun. 1999; 29p; In Dutch; In English

Report No.(s): AD-A367560; PML-1999-B23; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

Due to their relatively high strength-to-weight ratios, compared to aluminium alloys, as well as other advantages such as good corrosion resistance, the application of composite materials in future aircraft is growing fast. 1. However, the effect of composites on the vulnerability of fighter aircraft is not yet fully understood. The first step is to derive relationships for the determination of the residual velocity after penetration of the composite plates. Therefore a programme was started to conduct firing trials on three different types of composite plates of various thicknesses. This report presents the results of the firing trials and the derived relationships for the determination of the residual velocity after perforation of the composite plates.

DTIC

Fragments; High Strength; Plates (Structural Members); Penetration

19990116024 Army Research Lab., Human Research and Engineering Directorate, Aberdeen Proving Ground, MD USA

The Metallurgical Examination and Inspection of Apache Tail Rotor Strap Pack Laminates and Assemblies, *Mar. 1996 - Apr. 1997*

Grendahl, Scott M., Army Research Lab., USA; Jul. 1999; 137p; In English

Report No.(s): AD-A367980; ARL-TR-2018; No Copyright; Avail: CASI; A02, Microfiche; A07, Hardcopy

The U.S. Army Research Laboratory-Weapons and Materials Research Directorate (ARL-WMRD) performed a dimensional inspection and metallurgical investigation of AH-64 Apache tail rotor strap pack assemblies and individual laminate sets. All of the dimensional critical characteristics were examined in an attempt to determine the cause of a buckling phenomenon within the strap pack assemblies. Conformance to the manufacturer's governing specifications with respect to the material, heat treatment, and marking requirements was also investigated. The cause of the buckling was attributed to a combination of factors. Dimensional nonconformances were identified. Most of the hole diameters were found to be well below the specified range, causing the assemblies to be forced together. Transposition of the laminates during manufacture was also highly likely to have occurred, adding to the misalignment of the assembly. All other characteristics of the laminates and assemblies were found to conform to the governing part drawings and specifications.

DTIC

Metallurgy; Tail Rotors; Inspection; Misalignment; Visual Observation

19990116109 Wichita State Univ., Wichita, KS USA

Review of Damage Tolerance for Composite Sandwich Airframe Structures *Final Report*

Tomblin, J., Wichita State Univ., USA; Lacy, T., Wichita State Univ., USA; Smith, B., Wichita State Univ., USA; Hooper, S., Wichita State Univ., USA; Vizzini, A., Maryland Univ., USA; Lee, S., Maryland Univ., USA; Aug. 1999; 71p; In English

Report No.(s): AD-A367976; DOT/FAA/AR-99/49; No Copyright; Avail: CASI; A01, Microfiche; A04, Hardcopy

The use of composite sandwich construction is rapidly increasing in current and future airframe designs especially for general aviation aircraft and rotorcraft. Typically, sandwich constructions for these applications use thin-gage composite facesheets (0.020 in to 0.045 in) which are cocured to honeycomb and foam cores. Due to the nature of these structures, damage tolerance is more complex than conventional laminated structures. Besides typical damage concerns such as through penetration and delamination, additional modes including core crushing and facesheet debonding must also be addressed. This complicates the certification process by introducing undefined Allowable Damage Limits (ADL) and Critical Damage Thresholds (CDT) as related to the ultimate and limit load carrying capability of the structure. This document provides a background review of previous damage tolerance investigations including an overview of traditional metallic damage tolerance methodologies. illustrative summaries are presented which show the scope of previous investigation parameters such as impact energy, facesheet thickness, and core thickness of typical sandwich constructions. Also included is a compilation of damage tolerance certification procedures and regulations taken from FAR Part 23-29 for composite damage tolerance as well as recommendations from associated Advisory Circulars. Past and current airframe industry sandwich constructions which show the scope of current and future sandwich designs were also surveyed. In conclusion, a proposed future research approach and its methodology are presented which should aid in establishing certification guidelines and confidence involving the damage tolerance of sandwich constructions as they apply to general aviation aircraft and rotorcraft.

DTIC

Airframes; General Aviation Aircraft; Damage; Tolerances (Mechanics); Composite Structures; Sandwich Structures

19990116224 Department of Defense, Office of the Inspector General, Arlington, VA USA

Financial Management of the RAH-66 Comanche Helicopter Program

Aug. 06, 1998; 40p; In English

Report No.(s): AD-A367861; RN-98-185; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

This report is the second of a series of reports on the audit of the acquisition of the RAH-66 Comanche. This report addresses issues pertaining to the earned value management system, the award fee, and life-cycle costs. The Army spent $3.6 billion in research, development, test and evaluation funds through FY 1997 and is planning to spend and additional $4.3 billion through FY 2009. The Army plans to begin fielding the helicopter in 2006 for improved armed reconnaissance capability. Audit Objective. The audit objective was to evaluate the overall management of the Comanche Program. The specific objective of this portion of the audit was to evaluate the financial aspects of program management. The previous report, Inspector General, DoD, Report No. 98-125, covered the protection of the Comanche helicopter against radio frequency weapons, and a subsequent report will cover acquisition issues. We also reviewed the adequacy of the management control program as it applied to the specific stated audit objective. Audit Results. The Cost Performance Reports did not present an informative picture of the Comanche Program. Also, the process for determining the award fee was not fully documented. In addition, the life-cycle cost was underestimated.
DTIC

Financial Management; Project Management; Management Systems; Helicopters

19990116251 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA
Closely Supervised Reactive Control of an Uninhabited Aerial Vehicle
Glassco, Roy G.; Jun. 1999; 139p; In English
Report No.(s): AD-A364819; AFIT/GAE/ENY/99J-01; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

Closely Supervised Reactive Control is an alternative control method for uninhabited aerial vehicles that incorporates some of the benefits of both manual and autonomous operations. Utilizing an onboard camera, an operator can control a UAV by manually choosing desired targets. The flight path of the uninhabited vehicle is determined autonomously from the camera gimbal angles. The operator of the payload (i.e. camera), has close supervision of the aircraft. The aircraft, using an onboard computer, is given autonomous control to alter flight path to fly towards a target and at a specified range, loiter over the target. In the basic mode of operation, the camera operator must manually track the target providing continuous updates to the camera angles. In an advanced mode of operation with the use of an Integrated Navigation System (INS) or Global Positioning System (GPS), the aircraft autonomously determines the camera angles from a single locked position that the operator specifies. In this mode, the operator is free to look for other targets. This control method is being validated in the CAVE Automated Virtual Environment (CAVE) facility located at Wright Patterson AFB and owned and operated by Wright State University. The aircraft flight simulator used is FLSIM with the F-16 flight characteristics.
DTIC

Airborne/Spaceborne Computers; Cameras; Automatic Flight Control; Autonomous Navigation; Drone Aircraft

19990116394 NASA Langley Research Center, Hampton, VA USA
Multidisciplinary High-Fidelity Analysis and Optimization of Aerospace Vehicles, Part 1, Formulation
Walsh, J. L., NASA Langley Research Center, USA; Townsend, J. C., NASA Langley Research Center, USA; Salas, A. O., NASA Langley Research Center, USA; Samareh, J. A., NASA Langley Research Center, USA; Mukhopadhyay, V., NASA Langley Research Center, USA; Barthelemy, J.-F., NASA Langley Research Center, USA; [2000]; 20p; In English; 38th; Aerospace Sciences, 10-13 Jan. 2000, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): AIAA Paper 2000-0418; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

An objective of the High Performance Computing and Communication Program at the NASA Langley Research Center is to demonstrate multidisciplinary shape and sizing optimization of a complete aerospace vehicle configuration by using high-fidelity, finite element structural analysis and computational fluid dynamics aerodynamic analysis in a distributed, heterogeneous computing environment that includes high performance parallel computing. A software system has been designed and implemented to integrate a set of existing discipline analysis codes, some of them computationally intensive, into a distributed computational environment for the design of a highspeed civil transport configuration. The paper describes the engineering aspects of formulating the optimization by integrating these analysis codes and associated interface codes into the system. The discipline codes are integrated by using the Java programming language and a Common Object Request Broker Architecture (CORBA) compliant software product. A companion paper presents currently available results.
Author

Aerodynamic Characteristics; Aerospace Vehicles; Design Analysis; Structural Analysis; Elastic Properties

19990116395 NASA Langley Research Center, Hampton, VA USA
Airbreathing Hypersonic Vision-Operational-Vehicles Design Matrix
Hunt, James L., NASA Langley Research Center, USA; Pegg, Robert J., NASA Langley Research Center, USA; Petley, Dennis H., NASA Langley Research Center, USA; [1999]; 14p; In English; 1999 World Aviation Conference, 19-21 Oct. 1999, San

Francisco, CA, USA; Sponsored by Engineering Society for Advancing Mobility Land, Sea, USA
Report No.(s): Rept-1999-01-5515; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper presents the status of the airbreathing hypersonic airplane and space-access vision-operational-vehicle design matrix, with emphasis on horizontal takeoff and landing systems being, studied at Langley, it reflects the synergies and issues, and indicates the thrust of the effort to resolve the design matrix including Mach 5 to 10 airplanes with global-reach potential, pop-up and dual-role transatmospheric vehicles and airbreathing launch systems. The convergence of several critical systems/technologies across the vehicle matrix is indicated. This is particularly true for the low speed propulsion system for large unassisted horizontal takeoff vehicles which favor turbines and/or perhaps pulse detonation engines that do not require LOX which imposes loading concerns and mission Flexibility restraints.
Author
Air Breathing Engines; Hypersonic Vehicles; Transatmospheric Vehicles; Aircraft Launching Devices

19990116467 Naval Air Warfare Center, Aircraft Div., Patuxent River, MD USA
V-22 Operational Testing: Immersion of V-22 Aircraft into Simulated Threat Environment
Michelletti, Lynn; Huntt, Lynn H.; Ashburnllbaum, Steve; Huntt, Steve A.; Aug. 04, 1999; 10p; In English
Report No.(s): AD-A368639; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This paper describes Air Combat Environmental Test and Evaluation Facility's (ACETEF's) role as the M&S/ISTF tool in the support of the V-22 OT-IID testing and how ACETEF incorporated the HPC to meet operational test requirements. More specifically, it describes the scope of the test, the test requirements, what resources were used, and how various system capabilities were provided. It also identifies improvements for future testing based on the knowledge and experience gained in this exercise. The ongoing V-22 OT-IIE Operational Evaluation (OPEVAL) test event, lessons learned, and risk issues will be discussed.
DTIC
Simulation; Environmental Tests; Aircraft Performance

19990116656 Naval Air Warfare Center, Aircraft Div., Patuxent River, MD USA
Airborne Separation Video System Government Suitability Test
Crandall, Rob; Jun. 04, 1999; 14p; In English
Report No.(s): AD-A368478; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Due to decreasing DOD funds, the development of new tools to increase the efficiency of air vehicle/store compatibility testing was required. This need led to the design, manufacture, and test of the Airborne Separation Video System (ASVS). The ASVS is a high-speed digital imaging system that addresses the inefficiencies inherent in high-speed cameras/film as a primary recording medium for store separation events. Anticipated benefits from the ASVS are multiple buildup separation test points per flight (the store separation images can be telemetered to a ground station for qualitative analysis for near real-time analysis), a prerelease preview capability to ensure the cameras are functioning and image exposure is adequate, quicker turnaround between flights (no film processing requirements), and lower costs associated with not having to purchase, process, and dispose of the film. When the images are properly exposed, the ASVS is a suitable replacement for film and can be used to increase the efficiency of the air vehicle/store compatibility test process. The Air Force has and the Army will also conduct suitability tests.
DTIC
Digital Systems; Images; Airborne Equipment; Imaging Techniques

19990116658 Naval Air Warfare Center, Aircraft Div., Patuxent River, MD USA
Air-Launched Glider Delivery Vehicle for Standoff
Holler, Roger A.; Aug. 11, 1999; 36p; In English
Report No.(s): AD-A368482; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

NAWCAD is developing the X-Glider, an expendable aircraft-launched glider vehicle for the air deployment of sensors into denied or contested littoral areas while providing a safe standoff capability to the manned launch aircraft. The X-Glider is the size of a MK-46 torpedo and large enough to accommodate a range of payloads. It can be launched from the wing stations or bomb bay of tactical aircraft. Once launched, the X-Glider's autopilot autonomously guides the unpowered, 14-to-i glide-ratio vehicle to a predetermined location using GPS to achieve an aircraft standoff distance of 50 nmi, or more, from the hostile environment. The X-Glider is being developed under contract for NAWOAD by AeroVironment, Inc., of Simi Valley, California, and is sponsored by the Office of Naval Research.
DTIC
Gliders; Air Launching; Automatic Pilots

19990116705 NASA Langley Research Center, Hampton, VA USA

Robust Damage-Mitigating Control of Aircraft for High Performance and Structural Durability

Caplin, Jeffrey, Pennsylvania State Univ., USA; Ray, Asok, Pennsylvania State Univ., USA; Joshi, Suresh M., NASA Langley Research Center, USA; [1999]; 28p; In English

Contract(s)/Grant(s): NCC1-249; NSF DMI-94-24587; NSF CMS-95-31835; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper presents the concept and a design methodology for robust damage-mitigating control (DMC) of aircraft. The goal of DMC is to simultaneously achieve high performance and structural durability. The controller design procedure involves consideration of damage at critical points of the structure, as well as the performance requirements of the aircraft. An aeroelastic model of the wings has been formulated and is incorporated into a nonlinear rigid-body model of aircraft flight-dynamics. Robust damage-mitigating controllers are then designed using the H(infinity)-based structured singular value (mu) synthesis method based on a linearized model of the aircraft. In addition to penalizing the error between the ideal performance and the actual performance of the aircraft, frequency-dependent weights are placed on the strain amplitude at the root of each wing. Using each controller in turn, the control system is put through an identical sequence of maneuvers, and the resulting (varying amplitude cyclic) stress profiles are analyzed using a fatigue crack growth model that incorporates the effects of stress overload. Comparisons are made to determine the impact of different weights on the resulting fatigue crack damage in the wings. The results of simulation experiments show significant savings in fatigue life of the wings while retaining the dynamic performance of the aircraft.

Author

Aircraft Control; Damage; Durability; Aeroelasticity; Stress Distribution; Rigid Structures; Fatigue Life

19990116752 Southampton Univ., School of Engineering Sciences (Aeronautics and Astronautics), UK

Hypersonic Missiles: Some Problem Areas

East, R. A., Southampton Univ., UK; Edwards, J. A., Defence Evaluation Research Agency, UK; Missile Aerodynamics: Proceedings; 1999, pp. 8.1 - 8.11; In English; See also 19990116746; Copyright; Avail: Issuing Activity, Hardcopy

An overview of some of the problems, which have to be overcome in the design of hypersonic missiles or projectiles, is given. In the main, these are connected with the high levels of heat transfer rate suffered by such vehicles, particularly those induced by aerodynamic control surfaces. Some of the aspects of heat transfer, induced by, and suffered by such controls are presented. Data is presented and discussed, regarding the effects of flow separation due to flaps or flares, the effects of sharp and bluff fins (both swept and unswept) Finally, the aerodynamic interactions and heat transfer rates induced by reaction control jets are presented.

Author

Hypersonic Flight; Mathematical Models; Missile Design; Aerodynamic Heat Transfer; Control Surfaces; Aerodynamic Configurations; Boundary Layer Separation

19990116758 Bell/Agusta Aerospace Co., Fort Worth, TX USA

Tiltrotor Development to Meet Public Acceptability Targets

Reber, R., Bell/Agusta Aerospace Co., USA; The Potential of Rotocraft to Increase Airport Capacity: Proceedings; 1999, pp. 6.1 - 6.9; In English; See also 19990116754; Copyright; Avail: Issuing Activity, Hardcopy

Civil tiltrotor technology will literally change the way man flies! With the advent of modern vertical flight aircraft, like the tiltrotor, air travel will accede to new levels of convenience, safety, and cost-effectiveness. Tiltrotors can operate in all weather conditions from airports or from smaller facilities called vertiports strategically located to provide convenient access to other transportation systems. In evaluating the economic viability of this mode of travel, the entire cost of the system must be included to realize the benefits of such a system, not just the cost of the aircraft or its cost of operation. When an improved air transportation system is developed, tiltrotors, because of their time savings and cost competitiveness, will be able to compete in the 50-500 mile range with all types of airplanes as well as high-speed rail and other modes of transportation. While each mode has its advantages, tiltrotor will do well because it can add flexibility to the system and can complement the other modes and make the overall system more efficient. It will also be acceptable to the public at large because of its unique capability and low noise signature.

Author

XV-15 Aircraft; Acceptability; Air Transportation

19990116759 Eurocopter France, Marignane, France

Rotorcraft Technology and Products 2005/2015

Galland, P., Eurocopter France, France; The Potential of Rotocraft to Increase Airport Capacity: Proceedings; 1999, pp. 7.1 - 7.15; In English; See also 19990116754; Copyright; Avail: Issuing Activity, Hardcopy

This paper presents viewgraphs of Rotorcraft Technology and Products 2005/2015. Rotorcraft could bring a significant help in the passengers air transportation growth It is the aim of this presentation to demonstrate that rotorcraft have or will have the necessary features. Thanks to the technologies suitable for the development of the key operational capabilities, the rotorcraft community will propose a set of products able to help the passengers air transportation growth.
Derived from text
Rotary Wing Aircraft; Passengers; Air Transportation

19990116793 Naval Air Warfare Center, Aircraft Div., Patuxent River, MD USA
Cast Development for Aging Aircraft
Lei, Charles S.; Lee, Dui W.; Frazier, William E.; Waldman, Jeffrey; Mar. 25, 1999; 9p; In English
Report No.(s): AD-A368597; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

High quality investment castings have been increasingly selected for use on commercial and military aircraft due to their cost and weight benefits. Thin wall titanium and aluminum cast components have replaced many heavy complicate and manufacturing intensive, multipiece parts. Thick investment cast parts weighing up to 400 lb have become a reality. Also, welded titanium castings are being implemented on newly developed military aircraft. However, several issues critical for the wide implementation of this casting technology have yet to be adequately addressed: inspection of thick sections, effect of defects (porosity, shell inclusions, especially the halo zone) on the fatigue performance, heat treatment, lack of specifications, and applications of the casting factor. Another major casting implementation issue pertinent to our aging aircraft systems is the requirement for qualification testing. There are no clear guidelines as to whether or not costly and lengthy qualification tests are required for the substitution for eve part. This paper will discuss these issues and the efforts to overcome the problems.
DTIC
Military Aircraft; Investment Casting; Aging; Performance Tests

19990116795 Naval Air Warfare Center, Aircraft Div., Patuxent River, MD USA
Risk Management of an Aging KC-130 Fleet
Hoffman, Paul; Miller, Jennifer; Hoffman, Margery; Candella, James; Aug. 03, 1999; 22p; In English
Report No.(s): AD-A368599; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Typically, when one thinks of aging aircraft, safety is what comes to mind. However, another important aspect is readiness, that is the aircraft has to be available and reliable when needed. Prior to the aging aircraft problem by maintaining safety levels, the readiness requirements were satisfied automatically. Now even in satisfying safety demands, the aging aircraft phenomenon can run afoul of readiness. For the aging USMC KC-130 F/R fleet, a damage-tolerant approach ensured that safety would be maintained but it presented a problem in forecasting readiness, aircraft remaining in the inventory. Due to mission changes, the KC-130 F/R fleet is being subjected to higher fatigue loads than were imposed by the previous mission requirements. Consequently, the designated fatigue service limit is being approached at a much faster rate than initially expected. In turn, if the standard retirement criteria (Fatigue Life Expended, FLE index) were implemented, the fleet inventory would be depleted much more rapidly than originally planned. More emphatically, even if the removal from service criterion was set at a higher FLE greater than the standard of 100%, to gain some service time, the readiness issue remains. Because of the present distribution of FLEs for the fleet, the reduction in KC-130 aircraft inventory using even an FLE of 125% as the removal criterion is far greater than the projected acquisition of KC-130 J models.
DTIC
Risk; Aging; Aircraft Safety; Durability

19990116969 Naval Air Warfare Center, Aircraft Div., Patuxent River, MD USA
Joint Enhanced Rotorcraft Test and Operational Capability (JERTOC)
Carico, Dean; Slade, Chuck; Jun. 24, 1999; 13p; In English
Report No.(s): AD-A368560; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The DoD procurement account fell by more than 70% during the past decade. The cost associated with the next generation of rotorcraft design, analysis, testing, training, and support, using current techniques, promises to escalate in a predicted hostile fiscal environment. This cost must be reduced through the use of credible simulation and other analytical options. Conventional multi-service air vehicle flight testing is becoming more expensive and the test results may uncover problems late in the acquisition cycle, where making changes can be both costly and time consuming. Mission rehearsal training is normally conducted on operational flight trainers far removed from the battlefield site. A need exists to conduct joint service air vehicle testing analytically first, and to do mission rehearsal training at deployed sites. A need also exists to help integrate the design and test phases of the aircraft acquisition cycle and to do flight testing better, faster, cheaper, and safer. The JERTOC concept was

formulated as one approach to help realize the generic better/faster/ cheaper/safer criteria applied to T&E, as well as, to help achieve local flight test objectives of reducing TE cost and cycle time.
DTIC
Flight Tests; Flight Training; Helicopters; Rotary Wing Aircraft; Training Devices

19990117180 Defence Science and Technology Organisation, Information Technology Div., Melbourne, Australia
F-111 Bonded Panel Repair Status
Rider, Andrew N.; Apr. 1999; 37p; In English
Report No.(s): AD-A369418; DSTO-TR-0803; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A visit was made to Amberley Airbase between the 6th and 9th of September to consult with RAAF (Royal Australian Airforce) staff on current procedures and problems involved in the maintenance and repair of F-111 honeycomb panels. In conjunction with these discussions, a review of the current methods being used for honeycomb repair procedures was undertaken. The following report summaries the methods being used for repairs and the relevant reference documents. Also detailed are the major problems being encountered in these repairs and future problems which may arise as a result of the current status being maintained during the service life of the F-111.
DTIC
Honeycomb Structures; F-111 Aircraft; Panels; Aircraft Maintenance

19990117240 Air Force Materiel Command, Wright-Patterson AFB, OH USA
C-37 Qualification Operational Test and Evaluation
Jun. 21, 1999; 6p; In English
Report No.(s): AD-A366790; No Copyright; Avail: CASI; A01, Microfiche; A02, Hardcopy

The C-37A Commercial Aircraft IPT has received and studied the "C-37A (C-137 Replacement) Qualification Operational Test and Evaluation Final Report, March 1999". The team has conducted and completed assessments of possible courses of action to address the group prioritized DRs. This memo reports our selected course of action to correct concerns with the effectiveness and suitability of the C-37A for the SAM mission. In addressing the identified deficiencies, it is notable to report the C-37A compares exceptionally well with other mobility aircraft. For example, the, "C-17 IOT&E Final Report," documented 2,233 DRs. In fact, to the knowledge of the undersigned, there has been no aircraft in the Air Force inventory so well focused as the C-37A on the operational effectiveness and users needs. This is attributed to the integration and participation of the users in the Integrated Product Team from the beginning of the IPPD based missionization process.
DTIC
Performance Tests; Qualifications

06
AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices, and flight instruments.

19990107391 NASA Marshall Space Flight Center, Huntsville, AL USA
1999 Digital Avionics Highlights
Polites, Michael E., NASA Marshall Space Flight Center, USA; [1999]; 1p; In English; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

This article summarizes the highlights of recent events and developments in guidance, navigation, and control in space, aircraft, and weapons. This article is about 1,200 words long. Information for the article was collected from other NASA Centers, DoD, and industry. All information was previously cleared by the originating organizations. Information for the article was also gathered from Aviation Week and Space Technology, and similar sources.
Author
Guidance (Motion); Navigation; Spacecraft Control; Flight Control; Weapons

19990110310 NASA Dryden Flight Research Center, Edwards, CA USA
Flush Airdata Sensing (FADS) System Calibration Procedures and Results for Blunt Forebodies
Cobleigh, Brent R., NASA Dryden Flight Research Center, USA; Whitmore, Stephen A., NASA Dryden Flight Research Center, USA; Haering, Edward A., Jr., NASA Dryden Flight Research Center, USA; Borrer, Jerry, NASA Johnson Space Center, USA; Roback, V. Eric, NASA Langley Research Center, USA; November 1999; 34p; In English; 9th; International Space Planes and

Hypersonic Systems and Technologies, 1-5 Nov. 1999, Norfolk, VA, USA
Contract(s)/Grant(s): RTOP 242-33-02-00-23
Report No.(s): NASA/TP-1999-209012; NAS 1.60:209012; H-2379; AIAA Paper 99-4816; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Blunt-forebody pressure data are used to study the behavior of the NASA Dryden Flight Research Center flush airdata sensing (FADS) pressure model and solution algorithm. The model relates surface pressure measurements to the airdata state. Spliced from the potential flow solution for uniform flow over a sphere and the modified Newtonian impact theory, the model was shown to apply to a wide range of blunt-forebody shapes and Mach numbers. Calibrations of a sphere, spherical cones, a Rankine half body, and the F-14, F/A-18, X-33, X-34, and X-38 configurations are shown. The three calibration parameters are well-behaved from Mach 0.25 to Mach 5.0, an angle-of-attack range extending to greater than 30 deg, and an angle-of-sideslip range extending to greater than 15 deg. Contrary to the sharp calibration changes found on traditional pitot-static systems at transonic speeds, the FADS calibrations are smooth, monotonic functions of Mach number and effective angles of attack and sideslip. Because the FADS calibration is sensitive to pressure port location, detailed measurements of the actual pressure port locations on the flight vehicle are required and the wind-tunnel calibration model should have pressure ports in similar locations. The procedure for calibrating a FADS system is outlined.
Author
Calibrating; Detection; Forebodies; Mathematical Models; Pressure Measurement

19990116071 Sverdrup Technology, Inc., Huntsville, AL USA
System Engineering Issues for Avionics Survival in the Space Environment
Pavelitz, Steven, Sverdrup Technology, Inc., USA; [1999]; 1p; In English; Digital Avionics Systems, 26 Oct. 1997, Orvine, CA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): NAS8-40836; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

This paper examines how the system engineering process influences the design of a spacecraft's avionics by considering the space environment. Avionics are susceptible to the thermal, radiation, plasma, and meteoroids/orbital debris environments. The environment definitions for various spacecraft mission orbits (LEO/low inclination, LEO/Polar, MEO, HEO, GTO, GEO and High ApogeeElliptical) are discussed. NASA models and commercial software used for environment analysis are reviewed. Applicability of technical references, such as NASA TM-4527 "Natural Orbital Environment Guidelines for Use in Aerospace Vehicle Development" is discussed. System engineering references, such as the MSFC System Engineering Handbook, are reviewed to determine how the environments are accounted for in the system engineering process. Tools and databases to assist the system engineer and avionics designer in addressing space environment effects on avionics are described and usefulness assessed.
Author
Systems Engineering; Aerospace Systems; Avionics; Spacecraft Survivability; Aircraft Survivability; Spacecraft Design; Aircraft Design

19990116792 Naval Air Warfare Center, Aircraft Div., Patuxent River, MD USA
Next Generation Instrumentation Bus (NexGenBus)
Jones, Sidney R., Jr; Mar. 08, 1999; 14p; In English
Report No.(s): AD-A368591; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Traditionally, DoD has approached instrumentation as an afterthought. This was not because instrumentation was not an important part of the acquisition process, mostly, it was because there was adequate funding for the program and the instrumentation budget was buried in the noise. For years weapons platforms were developed with whatever instrumentation system was desired by the contractor. After EMD, when the test vehicles were turned over to the DoD, a lot of infrastructure was required to maintain sparing levels, maintain support equipment, and keep personnel trained. With today's diminishing defense budget, everything gets scrutinized, including instrumentation. Data requirements are increasing to feed information hungry simulations. At the same time, Local area network (LAN) speeds are reaching 10-100 time current instrumentation busses. Through sheer volume in the computer industry, PC's and peripherals are available at unheard of prices. A good way to keep instrumentation affordable was to leverage off the commercial sector. NexGenBus has researched available commercial busses and found several possible candidates. These candidates were investigated and revealed Fibre Channel as the most promising. Currently, Fibre Channel is being tested and analyzed in more detail to decide if it will be useful as an instrumentation bus.
DTIC
Avionics; Distributed Processing; Bus Conductors; Test Vehicles

19990116799 Naval Air Warfare Center, Aircraft Div., Patuxent River, MD USA

Joint Navy and Air Force Infrared Sensor Stimulator (IRSS) Program Installed Systems Test Facilities (ISTFs)

Joyner, Tom; Mar. 12, 1999; 13p; In English

Report No.(s): AD-A368613; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The OSD, Central Test and Evaluation Program (CTEIP) is tasked to provide a coordinated process for making joint investments in defense T&E to offset the challenges presented by declining investments in test assets and increasing test requirements. Under CTEIP sponsorship, the Navy and Air Force are jointly developing three Joint Installed System Test Facility (JISTF) enhancements that are based on dynamic virtual reality simulation technology. The three enhancements are the Infrared Sensor Stimulator (IRSS), Generic Radar Target Generator, and Joint Communications Simulator. The JISTF enhancement installations will occur at the Air Combat Environment Test and Evaluation Facility, NAWCAD Patuxent River, Maryland, and the Avionics Test and Integration Complex, Air Force Flight Test Center, Edwards Air Force Base, California. These enhancements will provide each ISTF with the capability to simultaneously test multiple avionics and sensor subsystems installed on an aerospace System Under Test (e.g., manned and unmanned aircraft) in a ground test environment. The ISTF enhanced test capabilities will be used to evaluate multisensor data fusion/correlation and subsystems' interoperability for IR sensors, RADAR, GPS, and Communications and Data Link subsystems. This paper address the IRSS which will be used to stimulate installed IR/UV EO sensors undergoing integrated developmental and operational testing. The IRSS program was first briefed at AEROSENSE 1996. This paper updates the capabilities and status of IRSS over the subsequent three years. It provides an overview of the IRSS subsystems and functions with emphasis on facility integration and discussion of the IR modeling, scene generation, and scene project components.

DTIC

Infrared Detectors; Flight Tests; Global Positioning System; Systems Simulation

07
AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and onboard auxiliary power plants for aircraft.

19990107334 NASA Dryden Flight Research Center, Edwards, CA USA

Inlet Flow Characteristics During Rapid Maneuvers for an F/A-18A Airplane

Steenken, William G., General Electric Co., USA; Williams, John G., General Electric Co., USA; Walsh, Kevin R., NASA Dryden Flight Research Center, USA; October 1999; 224p; In English

Contract(s)/Grant(s): NAS3-26617; RTOP 505-68-30

Report No.(s): NASA/TM-1999-206587; H-2371; NAS 1.15:206587; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

The F404-GE-400 engine powered F/A-18A High Alpha Research Vehicle (HARV) was used to examine the characteristics of inlet airflow during rapid aircraft maneuvers. A study of the degree of similarity between inlet data obtained during rapid aircraft maneuvers and inlet data obtained at steady aerodynamic attitudes was conducted at the maximum engine airflow of approximately 145 lBM/sec using a computer model that was generated from inlet data obtained during steady aerodynamic maneuvers. Results show that rapid-maneuver inlet recoveries agreed very well with the recoveries obtained at equivalent stabilized angle-of-attack conditions. The peak dynamic circumferential distortion values obtained during rapid maneuvers agreed within 0.01 units of distortion over the 10 - 38 degree angle of attack range with the values obtained during steady aerodynamic maneuvers while similar agreement was found for the peak dynamic radial distortion values up to 29 degrees angle-of-attack. Exceedences of the rapid-maneuver peak dynamic circumferential distortion values relative to the peak distortion model values at steady attitudes occurred only at low or negative angles of attack and were inconsequential from an engine-stability assessment point of view. The results of this study validate the current industry practice of testing at steady aerodynamic conditions to characterize inlet recovery and peak dynamic distortion levels.

Author

Air Flow; Air Intakes; Flow Characteristics; Research Aircraft; Intake Systems; Inlet Flow

19990109093 NASA Glenn Research Center, Cleveland, OH USA

The Effect of Air Preheat at Atmospheric Pressure on the Formation of NO(x) in the Quick-Mix Sections of an Axially Staged Combustor

Vardakas, M. A., California Univ., USA; Leong, M. Y., California Univ., USA; Brouwer, J., California Univ., USA; Samuelsen,

G. S., California Univ., USA; Holdeman, J. D., NASA Glenn Research Center, USA; September 1999; 28p; In English; Original contains color illustrations

Contract(s)/Grant(s): NCC3-412; RTOP 537-02-20

Report No.(s): NASA/TM-1999-209431; E-11872; NAS 1.15:209431; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Rich-burn/Quick-mix/Lean-burn (RQL) combustor concept has been proposed to minimize the formation of nitrogen oxides (NO(x)) in gas turbine systems. The success of this combustor strategy is dependent upon the efficiency of the mixing section bridging the fuel-rich and fuel-lean stages. Note that although these results were obtained from an experiment designed to study an RQL mixer, the link between mixing and NOx signatures is considerably broader than this application, in that the need to understand this link exists in most advanced combustors. The experiment reported herein was designed to study the effects of inlet air temperature on NO(x) formation in a mixing section. The results indicate that NO(x) emission is increased for all preheated cases compared to non-preheated cases. When comparing the various mixing modules, the affect of jet penetration is important, as this determines where NO(x) concentrations peak, and affects overall NO(x) production. Although jet air comprises 70 percent of the total airflow, the impact that jet air preheat has on overall NO(x) emissions is small compared to preheating both main and jet air flow.

Author

Atmospheric Pressure; Nitrogen Oxides; Jet Mixing Flow; Gas Pressure; Combustion Chambers; Gas Heating

19990110574 Rockwell International Corp., Los Angeles Aircraft Div., Los Angeles, CA USA

B-1 AFT Nacelle Flow Visualization Study

Celniker, Robert, Rockwell International Corp., USA; January 1975; 40p; In English

Contract(s)/Grant(s): NAS4-2182

Report No.(s): NASA/CR-1999-127493; NAS 1.26:127493; NA-74-626; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A 2-month program was conducted to perform engineering evaluation and design tasks to prepare for visualization and photography of the airflow along the aft portion of the B-1 nacelles and nozzles during flight test. Several methods of visualizing the flow were investigated and compared with respect to cost, impact of the device on the flow patterns, suitability for use in the flight environment, and operability throughout the flight. Data were based on a literature search and discussions with the test personnel. Tufts were selected as the flow visualization device in preference to several other devices studied. A tuft installation pattern has been prepared for the right-hand aft nacelle area of B-1 air vehicle No.2. Flight research programs to develop flow visualization devices other than tufts for use in future testing are recommended. A design study was conducted to select a suitable motion picture camera, to select the camera location, and to prepare engineering drawings sufficient to permit installation of the camera. Ten locations on the air vehicle were evaluated before the selection of the location in the horizontal stabilizer actuator fairing. The considerations included cost, camera angle, available volume, environmental control, flutter impact, and interference with antennas or other instrumentation.

Author

B-1 Aircraft; Nacelles; Flow Visualization; Flight Tests; High Speed Photography; Cameras

19990110605 NASA Glenn Research Center, Cleveland, OH USA

First NASA/Industry High Speed Research Program Nozzle Symposium

Long-Davis, Mary Jo, NASA Glenn Research Center, USA; First NASA/Industry High Speed Research Program Nozzle Symposium; September 1999; 788p; In English; 1st, 17-22 Nov. 1992, Cleveland, OH, USA; See also 19990110606 through 19990110643; Original contains color illustrations

Contract(s)/Grant(s): RTOP 537-05-23

Report No.(s): NASA/CP-1999-209423; E-11937; NAS 1.55:209423; No Copyright; Avail: CASI; A99, Hardcopy; A10, Microfiche

The First High Speed Research (HSR) Nozzle Symposium was hosted by NASA Lewis Research Center on November 17-19, 1992 in Cleveland, Ohio, and was sponsored by the HSR Source Noise Working Group. The purpose of this symposium was to provide a national forum for the government, industry, and university participants in the program to present and discuss important low noise nozzle research results and technology issues related to the development of appropriate nozzles for a commercially viable, environmentally compatible, U.S. High-Speed Civil Transport. The HSR Phase I research program was initiated in FY90 and is approaching the first major milestone (end of FY92) relative to an initial FAR 36 Stage 3 nozzle noise assessment. Significant research results relative to that milestone were presented. The opening session provided a brief overview of the Program and status of the Phase II plan. The next five sessions were technically oriented and highlighted recent significant

analytical and experimental accomplishments. The last Session included a panel discussion by the Session Chairs, summarizing the progress seen to date and discussing issues relative to further advances in technology necessary to achieve the Program Goals. Attendance at the Symposium was by invitation only and included only industry, academic, and government participants who are actively involved in the High-Speed Research Program. The technology presented in this meeting is considered commercially sensitive.
Author
Conferences; Low Noise; Nozzle Design; Nozzle Flow; Nozzle Efficiency; Technology Assessment

19990110606 General Electric Co., Aircraft Engines, Cincinnati, OH USA
Aero-Performance and Aero-Mixing Tests of 2D-CD Mixer/Ejector Nozzles, Part 1, Aero-Performance Tests
Askew, J. W., General Electric Co., USA; Yetter, J., General Electric Co., USA; First NASA/Industry High Speed Research Program Nozzle Symposium; September 1999, pp. 3-1 - 3-22; In English; See also 19990110605; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

The four objectives of the aerodynamic performance test of two-dimensional mixer/ejector nozzles: (1) Establish Aerodynamic Performance Characteristics and Design Criteria of 2D Suppressor Ejector Nozzles For Trade Studies At Take-Off Flight Conditions. (2) Quantify The Effects of Key Geometric And Aerodynamic Variables On Performance. (3) Test and Evaluate Geometric Parameter Variants Consistent With Those of Acoustic Test (e.g. Suppressor Area Ratio), and (4) Obtain Detailed Data That Can Be Used Later For Verifying And Validating CFD Codes For Performance Prediction of 2D Suppressor Ejector Nozzles. Derived from text
Aerodynamic Characteristics; Design Analysis; Performance Tests; Performance Prediction; Data Acquisition

19990110607 General Electric Co., Aircraft Engines, Cincinnati, OH USA
Aero-Performance and Aero-Mixing Tests of 2D-CD Mixer/Ejector Nozzles, Part 2, Sample of Aero-Mixing Test Data and Inference
Mengle, V. G., General Electric Co., USA; Shin, H–W., General Electric Co., USA; Askew, J. W., General Electric Co., USA; Whitfield, C. E., General Electric Co., USA; First NASA/Industry High Speed Research Program Nozzle Symposium; September 1999, pp. 3-23 - 3-35; In English; See also 19990110605; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

The tests on suppressor/ejector nozzle models conducted in G.E.'s Aerodynamic Research Laboratory (ARL) are supposed to complement the aero-performance tests, reported in Part 1, and the acoustic tests soon to be conducted in G.E.'s Cell 41. In particular, the tests were done with the above three objectives in mind, namely, to improve the understanding of internal and external fluid-dynamics of such nozzles, its aerodynamic characteristics (chute and ram drag etc.) and, to a lesser extent, CFD-code validation. In this brief paper, however, we focus only on the first objective, namely, a better understanding of the flow-field in terms of the internal mixing process and internal shock structures. Moreover, due to brevity of presentation only a limited amount of data is shown to give a flavor of the test results and, hence, only limited conclusions are drawn.
Author
Performance Tests; Performance Prediction; Nozzle Design; Two Dimensional Models; Suppressors; Ejectors

19990110608 General Electric Co., Aircraft Engines, Cincinnati, OH USA
Acoustic and Aero-Mixing Tests of Fluid Shield Nozzles, Part 1, Acoustics
Sailuddin, M., General Electric Co., USA; Brausch, J., General Electric Co., USA; Mengle, V., General Electric Co., USA; First NASA/Industry High Speed Research Program Nozzle Symposium; September 1999, pp. 4-1 - 4-19; In English; See also 19990110605; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

Environmental acceptability and economic viability are crucial issues in the development of the next generation HSCT (High Speed Civil Transport). Low noise exhaust nozzle technology has significant impact on both these issues. The exhaust system design that meets FAR 36 Stage 3 takeoff acoustic requirements and provides high levels of cruise and transonic performance and adequate takeoff performance at an acceptable weight is essential to the success of any HSCT program.
Author
Acceptability; Economics; Exhaust Nozzles; Exhaust Systems; Low Noise

19990110609 General Electric Co., Aircraft Engines, Cincinnati, OH USA
Acoustic and Aero-Mixing Tests of Fluid Shield Nozzles, Part 2, 2D-Fluid-Shield Nozzle Aero-Mixing Tests
Mengle, V. G., General Electric Co., USA; Shin, H–W., General Electric Co., USA; Whitfield, C., General Electric Co., USA; Wisler, S., General Electric Co., USA; Askew, J., General Electric Co., USA; First NASA/Industry High Speed Research Program Nozzle Symposium; September 1999, pp. 4-21 - 4-28; In English; See also 19990110605; No Copyright; Avail: CASI; A02,

Hardcopy; A10, Microfiche

The objective of the fluid-shield nozzle aero-mixing tests being conducted in GE's Aerodynamic Research Laboratory (AR) is to complement the acoustic tests done on such nozzles in GE's Cell 41. The focus is to help understand the fluid-dynamics and the aero-dynamics of such nozzles to improve their performance. In particular, we need a better understanding of: (a) the three-dimensional shock-structures that produce shock-associated noise, (b) the mixing process between the shield-flow, the core-flow, and the ambient flow which affects the fluid-shield evolution and acoustic efficiency, and (c) the pressure distributions on the chutes and the plug which affect the drag. The models in the ARL tests were, however, "two-dimensional" or rectangular in nature and the above figure shows the baseline model layout. It is similar to an if unwrapped" sector of the original round fluid-shield model used in Cell 41 and may also help in the design of future generation 2D fluid-shield nozzles. Shadowgraphs, laser velocimetry, and static pressure tap measurements were the primary tools used and planar laser sheet is planned to be used in the near future for flow visualization. The LV-system used, namely two-focus laser (L2F), is briefly described in the previous paper. This paper gives a flavor of typical tests results and insights obtained about flows in such nozzles.

Derived from text

Acoustic Measurement; Performance Tests; Aerodynamic Noise; Pressure Measurement; Nozzle Efficiency

19990110610 General Electric Co., Aircraft Engines, Cincinnati, OH USA

GE/Boeing Acoustic Test Axisymmetric Mixer/Ejector Nozzle

Brown, W. H., General Electric Co., USA; Bransch, J. F., General Electric Co., USA; First NASA/Industry High Speed Research Program Nozzle Symposium; September 1999, pp. 5-1 - 5-14; In English; See also 19990110605; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

Previous studies suggest that the keys to reducing the noise of heated jets are (1) reducing the shear velocity between the jet and the ambient and (2) absorbing as much of the mixing noise as possible before it can propagate to the farfield. Reducing the shear velocity is accomplished in the AMEN concept by the use of suppressor nozzles and ejectors. In the AMEN concept, the ejector entrains ambient air which is mixed with the engine air to reduce the overall velocity. The AMEN nozzle employs a suppressor area ratio greater than previous studies in an attempt to reduce the mixed jet velocity and obtain high levels of noise suppression at high jet velocities. Treatment of the ejector surface further enhances the acoustic performance by absorbing mixing noise before it can propagate to the ground. The suppressor nozzle itself serves two functions: (1) it enhances mixing by providing more shear area between the engine flow and entrained air, and (2) it reduces the characteristic dimension of the nozzle so that the wavelengths of the mixing noise are reduced. The use of a plug provides more surface for acoustic treatment as well as the possibility of using porosity to reduce shock noise within the ejector by wave cancellation off the plug surface. The efficacy of bulk absorbers at two different densities and of two plug surface porosities was evaluated both statically and in simulated flight with both flush and scoop inlets.

Derived from text

Mixers; Ejectors; Nozzle Design; Nozzle Efficiency; Acoustic Properties; Noise Reduction

19990110611 NASA Lewis Research Center, Cleveland, OH USA

Pratt & Whitney Two Dimensional HSR Nozzle Test in the NASA Lewis 9- by 15- Foot Low Speed Wind Tunnel: Aerodynamic Results

Wolter, John D., NASA Lewis Research Center, USA; Jones, Christopher W., Pratt and Whitney Aircraft, USA; First NASA/Industry High Speed Research Program Nozzle Symposium; September 1999, pp. 6-1 - 6-19; In English; See also 19990110605; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

This paper discusses a test that was conducted jointly by Pratt & Whitney Aircraft Engines and NASA Lewis Research Center. The test was conducted in NASA's 9- by 15-Foot Low Speed Wind Tunnel (9x15 LSWT). The test setup, methods, and aerodynamic results of this test are discussed. Acoustical results are discussed in a separate paper by J. Bridges and J. Marino.

Author

Performance Tests; Two Dimensional Models; Nozzle Geometry

19990110612 NASA Lewis Research Center, Cleveland, OH USA

Pratt & Whitney 2D Model in LeRC 9 ft x 15 ft Acoustics

Bridges, James, NASA Lewis Research Center, USA; Marino, Jodilyn, Pratt and Whitney Aircraft, USA; First NASA/Industry High Speed Research Program Nozzle Symposium; September 1999, pp. 7-1 - 7-21; In English; See also 19990110605; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

The theory of mixer-ejectors for noise suppression is illustrated in this cartoon. Since jet noise SPL scales as velocity to the eighth power and diameter squared, increasing the jet diameter while lowering its velocity and keeping thrust constant decreases

the noise. However, in supersonic craft, the drag penalty for increasing diameter at supersonic cruise makes this option very expensive. One would like to have a large engine during takeoff which could be shrunk during cruise. The retractable ejector is such an expandable engine. If the mixer flow can be expanded to the size of the ejector exit, the noise generated downstream of the ejector will be much less than the small diameter mixer nozzle alone. of course, this also requires that the noise created in expanding the flow to fill the ejector be absorbed by a liner in the ejector walls so that none of this noise is heard. Since this mixing of internal hot gas and external cold air must take place in as short a distance as possible, the mixer must be very effective and therefore probably much noisier than a simple nozzle.
Derived from text
Jet Aircraft Noise; Mixers; Noise Reduction; Two Dimensional Models

19990110613 Boeing Co., Seattle, WA USA
Test Results Boeing NFM Nozzle in LSAF
Nihart, G. L., Boeing Co., USA; First NASA/Industry High Speed Research Program Nozzle Symposium; September 1999, pp. 8-1 - 8-14; In English; See also 19990110605; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

The 1990 test nozzle was based on a design designated the Near-Fully Mixed (NFM) nozzle. The key features of this nozzle are: (1) 12 aspiration chutes that stay in the flow at all operating conditions. (2) Hinged flaps that change the primary nozzle throat area and expansion ratio. and (3) The flaps close off the aspiration flow at the cruise condition.
Author
Performance Tests; Nozzle Efficiency; Nozzle Design

19990110614 NASA Lewis Research Center, Cleveland, OH USA
Supersonic Jet Mixing Enhancement due to Natural and Induced Screech
Rice, E. J., NASA Lewis Research Center, USA; Raman, G., Sverdrup Technology, Inc., USA; First NASA/Industry High Speed Research Program Nozzle Symposium; September 1999, pp. 9-1 - 9-15; In English; See also 19990110605; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

Outline of presentation are: (1) Review of experimental apparatus. (2) Effect of natural screech of jet mixing; converging nozzle, underexpanded jet and converging-diverging nozzle, design pressure.(3) Effect of induced screech on jet mixing; produced by paddles in shear layers, similar to edge tones, and converging-diverging nozzle, design pressure. (4) Effect of paddles on near-field jet noise. and (5) Concluding remarks.
Author
Screech Tones; Convergent-Divergent Nozzles; Jet Aircraft Noise; Jet Mixing Flow; Nozzle Design; Combustion Stability

19990110615 NASA Lewis Research Center, Cleveland, OH USA
Mixing Enhancement in Supersonic Jets by Delta-Tabs
Zaman, K. B. M. Q., NASA Lewis Research Center, USA; First NASA/Industry High Speed Research Program Nozzle Symposium; September 1999, pp. 10-1 - 10-19; In English; See also 19990110605; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

The investigation includes carry out fundamental experiments studying mechanisms of effect: (1) experiments on subsonic and supersonic jets to assess influence of compressibility, (2) parametric study on tab geometry to optimize effect for given flow blockage (this effort led to "delta-tab"), (3) quantify mixing enhancement in the jet, and (4) analyze mechanism of streamwise vorticity generation.
Author
Compressibility; Experimentation; Subsonic Flow; Supersonic Jet Flow; Vorticity

19990110616 Georgia Inst. of Tech., Atlanta, GA USA
Vibrating Splitter Insert to Enhance Mixing and Reduce Supersonic Jet Noise
Ahuja, Krish K., Georgia Inst. of Tech., USA; First NASA/Industry High Speed Research Program Nozzle Symposium; September 1999, pp. 11-1 - 11-26; In English; See also 19990110605; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

A number of concepts of reducing supersonic jet noise have recently been tested using small-scale nozzles at Georgia Tech Research Institute by the author. One of them included a coaxial rectangular nozzle. Both nozzles had an equivalent diameter of 2 inches. This configuration provides considerable reduction in noise and also some control on the noise directivity. (See DGLR/AIAA 92-02-127: "Supersonic Jet Noise Reduction by Coaxial Rectangular Nozzles," by K. K. Ahuja, J. Manes, and K.

Massey.) It is shown in this presentation, that the inner nozzle can be replaced by splitter plates (inserts) that provide even further noise reduction at supersonic conditions through enhanced mixing.
Author
Noise Reduction; Supersonic Jet Flow; Nozzle Design

19990110618 University of Southern California, Dept. of Aerospace Engineering, Los Angeles, CA USA
Application of a Flip-Flop Nozzle on Plume Mixing Enhancement
Schreck, Stefan, University of Southern California, USA; Michaelian, Mark, University of Southern California, USA; Ho, Chih-Ming, California Univ., USA; First NASA/Industry High Speed Research Program Nozzle Symposium; September 1999, pp. 13-1 - 13-15; In English; See also 19990110605
Contract(s)/Grant(s): NAG1-1096; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

Mach wave radiation is a major source of noise in high speed jets. It is created by turbulent eddies which travel at supersonic speed within the shear layer of the jet. Downstream of the potential core, the convection speed of the eddies decays and noise production is reduced. Once the convection speeds drops below the speed of sound, eddy Mach wave radiation ceases. Mach wave radiation may be reduced by shortening the core length of the jet. This requires a faster growth of the shear layer, i.e. enhanced mixing in the jet. We investigated the possibility of mixing enhancement by the excitation of the instability waves in a supersonic rectangular jet.
Author
Flip-Flops; Nozzle Design; Augmentation; Electromagnetic Radiation; Mach Number; Sound Waves; Supersonic Jet Flow; Vortices

19990110619 NASA Langley Research Center, Hampton, VA USA
Effect of Swirl on Noise from a High Aspect Ratio Rectangular Nozzle
Ponton, M. K., NASA Langley Research Center, USA; Seiner, J. M., NASA Langley Research Center, USA; Mitchell, L. K., NASA Langley Research Center, USA; First NASA/Industry High Speed Research Program Nozzle Symposium; September 1999, pp. 14-1 - 14-15; In English; See also 19990110605; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

Based on extensive work performed by Dr. Thomas H. Sobota (Advanced Projects Research Incorporated (APRI)) on swirling flows in circular-to-rectangular transition sections, a model assembly was designed and fabricated in support of a Phase I Small Business Innovation Research Contract between the NASA-Langley Research Center and APRI. This assembly was acoustically tested as part of this Phase I effort, the goal being to determine whether the controlled introduction of axial vorticity could affect the various noise generation mechanisms present in an underexpanded supersonic rectangular jet.
Author
Fabrication; Design Analysis; Models; Acoustic Sounding; Performance Tests; Ductile-Brittle Transition

19990110620 NASA Langley Research Center, Hampton, VA USA
Application Focused Schlieren to Nozzle Ejector Flowfields
Mitchell, L. Kerry, NASA Langley Research Center, USA; Ponton, Michael K., NASA Langley Research Center, USA; Seiner, John M., NASA Langley Research Center, USA; Manning, James C., NASA Langley Research Center, USA; Jansen, Bernard J., Lockheed Engineering and Sciences Co., USA; Lagen, Nicholas T., Lockheed Engineering and Sciences Co., USA; First NASA/Industry High Speed Research Program Nozzle Symposium; September 1999, pp. 15-1 - 15-14; In English; See also 19990110605; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

The motivation of the testing was to reduce noise generated by eddy Mach wave emission via enhanced mixing in the jet plume. This was to be accomplished through the use of an ejector shroud, which would bring in cooler ambient fluid to mix with the hotter jet flow. In addition, the contour of the mixer, with its chutes and lobes, would accentuate the merging of the outer and inner flows. The objective of the focused schlieren work was to characterize the mixing performance inside of the ejector. Using flow visualization allowed this to be accomplished in a non-intrusive manner.
Author
Flow Distribution; Jet Flow; Noise Reduction; Nonintrusive Measurement; Plumes; Performance Tests

19990110621 NASA Lewis Research Center, Cleveland, OH USA
PARC Analysis of the NASA/GE 2D NRA Mixer/Ejector Nozzle
DeBonis, J. R., NASA Lewis Research Center, USA; First NASA/Industry High Speed Research Program Nozzle Symposium; September 1999, pp. 16-1 - 16-32; In English; See also 19990110605; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

Interest in developing a new generation supersonic transport has increased in the past several years. Current projections indicate this aircraft would cruise at approximately Mach 2.4, have a range of 5000 nautical miles and carry at least 250 passengers. A large market for such an aircraft will exist in the next century due to a predicted doubling of the demand for long range air transportation by the end of the century and the growing influence of the Pacific Rim nations. Such a proposed aircraft could more than halve the flying time from Los Angeles to Tokyo. However, before a new economically feasible supersonic transport can be built, many key technologies must be developed. Among these technologies is noise suppression. Propulsion systems for a supersonic transport using current technology would exceed acceptable noise levels. All new aircraft must satisfy FAR 36 Stage III noise regulations. The largest area of concern is the noise generated during takeoff. A concerted effort under NASA's High Speed Research (HSR) program has begun to address the problem of noise suppression. One of the most promising concepts being studied in the area of noise suppression is the mixer/ejector nozzle. This study analyzes a typical noise suppressing mixer ejector nozzle at take off conditions, using a Full Navier-Stokes (FNS) computational fluid dynamics (CFD) code.

Author

Ejectors; Mixers; Noise Intensity; Noise Reduction; Propulsion System Configurations; Supersonic Transports

19990110622 United Technologies Research Center, East Hartford, CT USA

Analysis of a Second Generation Mixer-Ejector Exhaust System

Barber, T. J., United Technologies Research Center, USA; LaBarre, R. E., United Technologies Research Center, USA; Chiappetta, L. M., United Technologies Research Center, USA; First NASA/Industry High Speed Research Program Nozzle Symposium; September 1999, pp. 17-1 - 17-35; In English; See also 19990110605; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

Analysis Background, Grid Generation Approach, Navier-Stokes Analysis Approach, and Discussion of Results are outlined. This presentation will describe previous approaches for analyzing mixer-type nozzle geometries. A key reason preventing a complete numerical solution has been short-coming in grid generation. A new grid generation procedure will be described and Navier-Stokes solutions obtained using such a grid will be presented. Finally, comparisons with experimental data measured in the NASA Lewis RC 9 by 12 tunnel will be presented.

Author

Systems Analysis; Grid Generation (Mathematics); Exhaust Systems; Ejectors

19990110623 NASA Lewis Research Center, Cleveland, OH USA

PAR Analysis of HSR Nozzles

Georgiadis, Nicholas J., NASA Lewis Research Center, USA; First NASA/Industry High Speed Research Program Nozzle Symposium; September 1999, pp. 18-1 - 18-21; In English; See also 19990110605; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

Only recently has computational fluid dynamics (CFD) been relied upon to predict the flow details of advanced nozzle concepts. Computer hardware technology and flow solving techniques are advancing rapidly and CFD is now being used to analyze such complex flows. Validation studies are needed to assess the accuracy, reliability, and cost of such CFD analyses. At NASA Lewis, the PARC2D/3D full Navier-Stokes (FNS) codes are being applied to HSR-type nozzles. This report presents the results of two such PARC FNS analyses. The first is an analysis of the Pratt and Whitney 2D mixer-ejector nozzle, conducted by Dr. Yunho Choi (formerly of Sverdrup Technology-NASA Lewis Group). The second is an analysis of NASA-Langley's axisymmetric single flow plug nozzle, conducted by the author.

Author

Axisymmetric Flow; Plug Nozzles; Computer Programs; Nozzle Design

19990110624 Science Applications International Corp., Fort Washington, PA USA

Status on Numerical Computation of Supersonic Jet Plumes

Dash, Sanford M., Science Applications International Corp., USA; First NASA/Industry High Speed Research Program Nozzle Symposium; September 1999, pp. 19-1 - 19-45; In English; See also 19990110605; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

This paper will provide an overview of our status to predict the structure of supersonic jet plumes as relevant to noise suppression research for the High-Speed Civil Transport (HSCT) program. Topics to be discussed will include: the CFD codes utilized; advances made in turbulence modeling; an ability to analyze complex flows; and, the present utility of unsteady flow simulations.

Author

Supersonic Jet Flow; Plumes; Noise Reduction; Simulation; Turbulence Models

19990110625 Ohio State Univ., Columbus, OH USA

Analysis of Numerical Methods for Application to Jet Noise Problems

Scott, J. N., Ohio State Univ., USA; First NASA/Industry High Speed Research Program Nozzle Symposium; September 1999, pp. 20-1 - 20-24; In English; See also 19990110605; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

Contents include the following: (1) Review results of Navier-Stokes solutions of unsteady jet flow. (2) Analysis of numerical methods using solutions of model problems. (3) Stability and accuracy analysis: viscous Burgers equation, and (4) Propagation of acoustic disturbances: linearized Euler equations.

Derived from text

Numerical Analysis; Jet Aircraft Noise; Unsteady Flow; Accuracy

19990110638 NASA Lewis Research Center, Cleveland, OH USA

Assessment of Integrated Nozzle Performance

Lambert, H. H., NASA Lewis Research Center, USA; Mizukami, M., NASA Lewis Research Center, USA; First NASA/Industry High Speed Research Program Nozzle Symposium; September 1999, pp. 33-1 - 33-19; In English; See also 19990110605; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

This presentation highlights the activities that researchers at the NASA Lewis Research Center (LeRC) have been and will be involved in to assess integrated nozzle performance. Three different test activities are discussed. First, the results of the Propulsion Airframe Integration for High Speed Research 1 (PAIHSR1) study are presented. The PAIHSR1 experiment was conducted in the LeRC 9 ft x 15 ft wind tunnel from December 1991 to January 1992. Second, an overview of the proposed Mixer/ejector Inlet Distortion Study (MIDIS-E) is presented. The objective of MIDIS-E is to assess the effects of applying discrete disturbances to the ejector inlet flow on the acoustic and aero-performance of a mixer/ejector nozzle. Finally, an overview of the High-Lift Engine Aero-acoustic Technology (HEAT) test is presented. The HEAT test is a cooperative effort between the propulsion system and high-lift device research communities to assess wing/nozzle integration effects. The experiment is scheduled for FY94 in the NASA Ames Research Center (ARC) 40 ft x 80 ft Low Speed Wind Tunnel (LSWT).

Author

Acoustic Properties; Aerodynamic Noise; Engine Tests; High Temperature Tests; Inlet Flow; Nozzle Efficiency; Experimentation

19990110639 NASA Langley Research Center, Hampton, VA USA

High Temperature Acoustic Liner Technology

Parrott, Tony L., NASA Langley Research Center, USA; Jones, Michael G., Lockheed Engineering and Sciences Co., USA; Posey, Joe W., NASA Langley Research Center, USA; First NASA/Industry High Speed Research Program Nozzle Symposium; September 1999, pp. 34-1 - 34-17; In English; See also 19990110605; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

This paper describes work currently in progress at Langley on liner concepts that employ structures that may be suitable for broadband exhaust noise attenuation in high speed flow environments and at elevated temperatures characteristic of HSCT applications. Because such liners will need to provide about 10 dB suppression over a 2 to 3 octave frequency range, conventional single-degree-of-freedom resonant structures will not suffice. Bulk absorbers have the needed broadband absorption characteristic; however, at lower frequencies they tend to be inefficient.

Author

Noise Reduction; High Speed; Broadband; Exhaust Nozzles; High Temperature

19990110640 NASA Lewis Research Center, Cleveland, OH USA

Exhaust Nozzle Materials Development for the High Speed Civil Transport

Grady, J. E., NASA Lewis Research Center, USA; First NASA/Industry High Speed Research Program Nozzle Symposium; September 1999, pp. 35-1 - 35-21; In English; See also 19990110605; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

The USA has embarked on a national effort to develop the technology necessary to produce a Mach 2.4 High Speed Civil Transport (HSCT) for entry into service by the year 2005. The viability of this aircraft is contingent upon its meeting both economic and environmental requirements. Two engine components have been identified as critical to the environmental acceptability of the HSCT. These include a combustor with significantly lower emissions than are feasible with current technology, and a lightweight exhaust nozzle that meets community noise standards. The Enabling Propulsion Materials (EPM) program will develop the advanced structural materials, materials fabrication processes, structural analysis and life prediction tools for the HSCT combustor and low noise exhaust nozzle. This is being accomplished through the coordinated efforts of the NASA Lewis Research Center, General Electric Aircraft Engines and Pratt & Whitney. The mission of the EPM Exhaust Nozzle

Team is to develop and demonstrate this technology by the year 1999 to enable its timely incorporation into HSCT propulsion systems.

Author

Technology Assessment; Aircraft Engines; Engine Design; Combustion Chambers; Exhaust Nozzles; Fabrication; Propulsion System Performance

19990110693 DYNACS Engineering Co., Inc., Brook Park, OH USA

SiC/SiC Leading Edge Turbine Airfoil Tested Under Simulated Gas Turbine Conditions *Final Report*

Robinson, R. Craig, DYNACS Engineering Co., Inc., USA; Hatton, Kenneth S., AlliedSignal Composites, Inc., USA; September 1999; 16p; In English; 23rd; Composites, Materials and Structures, 25-29 Jan. 1999, Cocoa Beach, FL, USA; Sponsored by American Ceramic Society, USA

Contract(s)/Grant(s): SAA3-145; RTOP 505-23-2F

Report No.(s): NASA/CR-1999-209314; E-11919; NAS 1.26:209314; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Silicon-based ceramics have been proposed as component materials for use in gas turbine engine hot-sections. A high pressure burner rig was used to expose both a baseline metal airfoil and ceramic matrix composite leading edge airfoil to typical gas turbine conditions to comparatively evaluate the material response at high temperatures. to eliminate many of the concerns related to an entirely ceramic, rotating airfoil, this study has focused on equipping a stationary metal airfoil with a ceramic leading edge insert to demonstrate the feasibility and benefits of such a configuration. Here, the idea was to allow the SiC/SiC composite to be integrated as the airfoil's leading edge, operating in a "free-floating" or unrestrained manner, and provide temperature relief to the metal blade underneath. The test included cycling the airfoils between simulated idle, lift, and cruise flight conditions. In addition, the airfoils were air-cooled, uniquely instrumented, and exposed to the same internal and external conditions, which included gas temperatures in excess of 1370 C (2500 F). Results show the leading edge insert remained structurally intact after 200 simulated flight cycles with only a slightly oxidized surface. The instrumentation clearly suggested a significant reduction (approximately 600 F) in internal metal temperatures as a result of the ceramic leading edge. The object of this testing was to validate the design and analysis done by Materials Research and Design of Rosemont, PA and to determine the feasibility of this design for the intended application.

Author

Silicon; Leading Edges; Airfoils; Gas Turbine Engines; Design Analysis

19990114314 Central Inst. of Aviation Motors, Moscow, Russia

Design Investigation of Turbojet using Fuel Cooling Capacity for the 1st Stage of TSTO Aerospace System

Dembo, N., Lyulka Saturn, Inc., Russia; Chepkin, V., Lyulka Saturn, Inc., Russia; Goyhenberg, M., Lyulka Saturn, Inc., Russia; Lanshin, A., Central Inst. of Aviation Motors, Russia; [1999]; 14p; In English; 9th; 3rd; International Space Planes and Hypersonic Systems and Technologies, 1-5 Nov. 1999, Norfolk, VA, Norfolk, VA, USA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): AIAA Paper 99-4842; Copyright; Avail: Issuing Activity, Hardcopy

Cooperating under the program "Oryol", Lyulka Saturn, Inc. together with CIAM are being developed different variants of turbojets operating in speed range of M = 0...6 for aircraft - accelerator of aerospace system. Optimal turbojet engine must meet with increased requirements for specific and relative thrust at supersonic flight regimes, engine efficiency at cruise subsonic regimes with minimal specific weight, and nominal overall dimensions. The results of investigations as well as design and development work of high-temperature hydrogen turbojets designed with air-fuel heat exchangers before compressors are presented. The hydrogen TFAB with air-fuel heat exchanger before inner flow compressor is taken as an example. The parameters, control programs and technical design of main components allowing to provide high engine requirements are based on the results of investigations. The comparison of main data of developed engines, proposals on further investigations including international cooperation are described in the paper.

Author

Turbojet Engines; Ramjet Engines; Engine Design; Thermodynamic Properties; Turboramjet Engines; Turbofan Engines; Turbofans; Afterburning

19990114315 Central Inst. of Aviation Motors, Moscow, Russia

Status of "ORYOL-2-1" R and D Program, Combined Propulsion Systems for SSTO and TSTO

Lanshin, A., Central Inst. of Aviation Motors, Russia; Sosunov, V., Central Inst. of Aviation Motors, Russia; [1999]; 16p; In English; 9th; 3rd; International Space Planes and Hypersonic Systems and Technologies, 1-5 Nov. 1999, Norfolk, VA, Norfolk,

VA, USA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): AIAA Paper 99-4810; Copyright; Avail: Issuing Activity, Hardcopy

"ORYOL-2-1" R&D program is a component of the Russian Space Agency "ORYOL" R&D program. It includes R&D of the combined propulsion systems for the hypersonic SSTO and TSTO aerospace planes. The leading Russian Design Bureaus, Research Institutes, RAS Institutes and Universities take part in "ORYOL2-1" R&D program together with Central Institute of Aviation Motors and "CIAM" R&DC, Ltd. The given report represents the "ORYOL-2-1" R&D program activities in 1997-98 including results of the design and technological works and some generalizes connected to choice of the rational variants and directions of the further CPS "key" technologies investigations.
Author
Propulsion System Configurations; Propulsion System Performance; Research and Development

19990114846 Johns Hopkins Univ., Chemical Propulsion Information Agency, Columbia, MD USA
JANNAF Airbreathing Propulsion Subcommittee and 35th Combustion Subcommittee Meeting, Volume I
Fry, Ronald S., Editor, Johns Hopkins Univ., USA; Gannaway, Mary T., Editor, Johns Hopkins Univ., USA; Rognan, Melanie, Editor, Johns Hopkins Univ., USA; December 1998; 76p; In English; 35th; Airbreathing Propulsion Subcommittee, 7-11 Dec. 1998, Tucson, AZ, Tucson, AZ, USA, USA; Sponsored by NASA, USA; See also 19990114847 through 19990114851
Contract(s)/Grant(s): SPO700-97-D-4004
Report No.(s): CPIA-Publ-682-Vol-1; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC, Hardcopy

This document, CPIA Publication 682, Volume 1, is a compilation of 5 unclassified/unlimited technical papers (approved for public release) which were presented at the 1998 meeting of the Joint Army-Navy-NASA-Air Force (JANNAF) Airbreathing Propulsion Subcommittee (APS) and Combustion Subcommittee (CS) held jointly with the Propulsion Systems Hazards Subcommittee (PSHS). The meeting was held on 7-11 December 1998 at Raytheon Systems Company and the Marriott Hotel, Tucson, AZ. Topics covered include HyTech technology development, hydrocarbon fuel development for hypersonic applications, pulse detonation propulsion system development and arc heaters for direct-connect scramjet testing.
Author
Conferences; Air Breathing Engines; Heating Equipment; Propulsion System Configurations; Propulsion System Performance; Systems Engineering

19990114850 General Applied Science Labs., Inc., Ronkonkoma, NY USA
Three-Component Force Measurements on a Scramjet in a Reflected-Shock Tunnel
Tsai, C.-Y., General Applied Science Labs., Inc., USA; Bakos, R. J., General Applied Science Labs., Inc., USA; Mee, D. J., Queensland Univ., Australia; JANNAF Airbreathing Propulsion Subcommittee and 35th Combustion Subcommittee Meeting; December 1998; Volume 1, pp. 35-52; In English; See also 19990114846
Contract(s)/Grant(s): NAS1-97027; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC, Hardcopy

A three-component stress-wave force-balance for a large scramjet has been designed, calibrated and tested in the HYPULSE reflected shock tunnel at GASL Inc., New York. The scramjet model is over 3-foot long and weighs in excess of 90 lBM. The stress-wave force-balance is comprised of three stress bars which are attached to the model. Calibration results indicate that the force balance responds well within about 1 ms and that the sensitivity of the balance to the distribution of load is not large. Results with and without fuel injection were obtained in the tunnel operated for Mach 7 and Mach 10 flight simulation. These tests showed the force-balance can resolve axial force increments due to combustion of about 40 lb in the presence of model lift forces of 500-700 lb.
Author
Stress Waves; Design Analysis; Calibrating; Performance Tests; Loads (Forces); Supersonic Combustion Ramjet Engines

19990114851 Sverdrup Technology, Inc., Arnold Engineering Development Center Group, Arnold AFS, TN USA
Issues Relating to the use of Arc Heaters for Direct-Connect Scramjet Testing
Felderman, E. J., Sverdrup Technology, Inc., USA; JANNAF Airbreathing Propulsion Subcommittee and 35th Combustion Subcommittee Meeting; December 1998; Volume 1, pp. 53-58; In English; See also 19990114846; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC, Hardcopy

Issues relating to the use of arc-heated air for scramjet direct-connect testing are discussed. Direct- connect simulation issues are reviewed. The ability to satisfy simulation requirements is addressed. The effect of NO and copper contamination is discussed.

as well as spatial and temporal flow fluctuations. It is concluded that arc heaters can provide a useful test environment in the simulated Mach number range, Mfsub sim) = 6-10.

Author

Arc Heating; Supersonic Combustion Ramjet Engines; Simulation

19990116985 SRI International Corp., Menlo Park, CA USA

Improved Barriers to Turbine Engine Fragments *Interim Report*

Shockey, Donald A.; Simons, Jeffrey W.; Erlich, David C.; Jul. 1999; 30p; In English

Contract(s)/Grant(s): 95-G-010

Report No.(s): AD-A368841; SRI-7412; DOT/FAA/AR-99/8; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Because fragments from in-flight engine failures can damage critical aircraft components and produce catastrophic consequences, the Federal Aviation Administration is sponsoring research to mitigate the effects of uncontained engine bursts. SRI International is evaluating the ballistic effectiveness of fabric structures made from advanced polymers and developing a computational ability to design fragment barriers. In this reporting period, SRI solved several numerical problems associated with modeling the crimped geometry and interaction of woven yarns. When an orthotropic model is invoked and direction-dependent yarn properties specified, the yarn, as it is loaded, exhibits no appreciable stiffness until it straightens. The model behaved properly in simple simulations of single yarn response to axial and transverse loads. Laboratory and field site tests were performed to provide data for developing and validating the computational model. The ballistic response of fabrics to fragment impact was evaluated; the phenomenology of fabric deformation and failure was elucidated in quasi-static penetration tests; and the tensile properties of yarns and fibers were measured. Three high-strength polymer materials were examined: PBO (Zylon), aramid (Kevlar), and polyethylene (Spectra). Future work will include verification of the microstructural fabric model by implementing it into the DYNA3D code, simulating the static and dynamic penetration tests, and comparing the results. The material properties most important in resisting penetration will be identified and the effects of boundary conditions investigated. SRI will also perform fragment impact tests to generate data on boundary condition effects, measure yarn-on-yarn friction, and participate in full-scale fragment barrier tests at the Navy Air Warfare Center.

DTIC

Research; Boundary Conditions; Damage; Deformation; Fiber Composites; Full Scale Tests; Static Tests; Tensile Properties; Turbine Engines

08
AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

19990061885 NASA Dryden Flight Research Center, Edwards, CA USA

Wavelet Applications for Flight Flutter Testing

Lind, Rick, NASA Dryden Flight Research Center, USA; Brenner, Marty, NASA Dryden Flight Research Center, USA; Freudinger, Lawrence C., NASA Dryden Flight Research Center, USA; 1999; 10p; In English; International Forum on Aeroelasticity and Structural Dynamics, 22-25 Jun. 1999, Williamsburg, VA, USA

Report No.(s): H-2364; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Wavelets present a method for signal processing that may be useful for analyzing responses of dynamical systems. This paper describes several wavelet-based tools that have been developed to improve the efficiency of flight flutter testing. One of the tools uses correlation filtering to identify properties of several modes throughout a flight test for envelope expansion. Another tool uses features in time-frequency representations of responses to characterize nonlinearities in the system dynamics. A third tool uses modulus and phase information from a wavelet transform to estimate modal parameters that can be used to update a linear model and reduce conservatism in robust stability margins.

Author

Flutter Analysis; Wavelet Analysis; Flight Envelopes; Aeroelasticity; Nonlinear Systems; Signal Processing; Dynamical Systems; Flight Stability Tests

19990110571 National Aerospace Lab., Tokyo, Japan

Anti-Symmetric Mode Flutter of Winged Reentry Space Vehicle

Kanda, A., National Aerospace Lab., Japan; Ueda, T., National Aerospace Lab., Japan; December 1997; 30p; In Japanese

Report No.(s): PB99--127722; NAL/TR-1342; Copyright Waived; Avail: Issuing Activity (Natl Technical Information Service

(NTIS), Microfiche

The reentry winged space vehicle "HOPE" projects is proceeding. HOPE has a tip-fin wing which forms a non-planar wing. Anti-symmetric mode flutter experiments were conducted on a similar configuration model to HOPE by using the sting supporting system in which the rolling mode can be controlled in a transonic wind tunnel (NAL). Several flutter points have been obtained for a single model. The results of the experiments and those of the analysis by DPM (Doublet-Point Method) are compared. The comparison shows good agreement in the subsonic region. In the supersonic region, however, the experimental flutter speed rise considerably, making the analytical results conservative. It has a tendency to agree again as the Mach number increases.

NTIS

Flutter Analysis; Reentry Vehicles; Aerodynamic Forces; Wing Profiles; Wind Tunnel Tests; Transonic Flow; Hope Aerospace Plane

19990111735 NASA Langley Research Center, Hampton, VA USA

Advanced Aerodynamic Control Effectors

Wood, Richard M., NASA Langley Research Center, USA; Bauer, Steven X. S., NASA Langley Research Center, USA; 1998; 14p; In English; 1999 World Aviation Congress, 19-21 Oct. 1999, San Francisco, CA, USA; Sponsored by Society of Automotive Engineers, Inc.

Report No.(s): SAE-1999-01-5619; Copyright; Avail: Issuing Activity, Hardcopy

A 1990 research program that focused on the development of advanced aerodynamic control effectors (AACE) for military aircraft has been reviewed and summarized. Data are presented for advanced planform, flow control, and surface contouring technologies. The data show significant increases in lift, reductions in drag, and increased control power, compared to typical aerodynamic designs. The results presented also highlighted the importance of planform selection in the design of a control effector suite. Planform data showed that dramatic increases in lift (> 25%) can be achieved with multiple wings and a sawtooth forebody. Passive porosity and micro drag generator control effector data showed control power levels exceeding that available from typical effectors (moving surfaces). Application of an advanced planform to a tailless concept showed benefits of similar magnitude as those observed in the generic studies.

Author

Aerodynamics; Control Equipment; Planforms; End Effectors

19990114890 Naval Postgraduate School, Monterey, CA USA

A Computational and Experimental Investigation of a Flutter Generator

Davids, Scott T., Jun. 1999; 106p; In English

Report No.(s): AD-A367882; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The phenomenon of flutter is well known to aircraft designers. A fluttering wing on an aircraft absorbs a significant amount of energy from the air-stream. In this study, computational and experimental methods are used to investigate the possibility of extracting power from a flow using an oscillating airfoil. A numerical analysis is conducted using an unsteady panel code based on potential flow theory. Through the numerical study the combination of parameters is determined that results in the optimum performance of an oscillating-wing power generator. An experimental oscillating-wing power generator is described and tested in a water tunnel. Power and efficiency measurements from the generator are compared to the numerical results. Similar trends between the results suggest that an oscillating-wing power generator is capable of performance comparable to windmills and is a potential source of alternative power.

DTIC

Flutter; Flow Theory; Oscillating Flow; Air Flow; Numerical Analysis

19990114899 NASA Langley Research Center, Hampton, VA USA

Piloted Simulation Investigation of a Supersonic Transport Configuration (LaRC-4)

Jackson, E. Bruce, NASA Langley Research Center, USA; Martinez, Debbie, NASA Langley Research Center, USA; Derry, Stephen D., NASA Langley Research Center, USA; September 1999; 92p; In English

Contract(s)/Grant(s): RTOP 537-07-52

Report No.(s): NASA/TM-1999-209557; NAS 1.15:209557; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This report contains a description of the test facilities and software utilized during a joint NASA/aerospace industry study of improved control laws and desired inceptor characteristics for a candidate supersonic transport air-craft design. Details concerning the characteristics of the simulation cockpit, image generator and display systems, and motion platform are described. Depictions of the various display formats are included. The test schedule, session log, and flight cards describing the maneuvers

performed is included. A brief summary of high-lights of the study is given. Modifications made to the industry-provided simulation model are described. This report is intended to serve as a reference document for industry researchers.
Author
Supersonic Transports; Simulation; Control Theory; Display Devices

19990115878 Cranfield Univ., Flight Test and Dynamics Group, Bedford, UK
The Stability and Control Characteristics of the Neutrally Bouyant Non-Rigid Airship
Goineau, F., Cranfield Univ., UK; Cook, M. V., Cranfield Univ., UK; August 1999; 46p; In English
Report No.(s): COA-9911; ISBN 1-861940-459; Copyright; Avail: Issuing Activity, Hardcopy

The response to controls of a neutrally buoyant non-rigid airship was investigated for a range of speeds from the hover to 30 m/s using a non-linear simulation model. The responses shown include both flight path and a range of motion variables. The latter show the influence of the stability modes on control. The controls included in the airship model comprise equivalent elevator, equivalent rudder, thrust magnitude and thrust vector direction. A linearised state model of the airship was obtained from the simulation model for a range of speeds from the hover to 30 m/s. The validity of the linearised model for short term evaluation of stability and control was confirmed by matching linear response plots with those obtained from the simulation model. by making assumptions about the nature of response, the state equations were simplified to enable algebraic approximations for the stability modes to be derived by analysis. The approximate models were shown to compare favourably with the actual modes obtained in the solution of the equations of motion.
Author
Computerized Simulation; Airships; Mathematical Models; Aerodynamic Stability; Airspeed; Controllability; Buoyancy

19990116206 Department of the Navy, Washington, DC USA
Sharp memory actuator system
Jul. 31, 1998; 10p; In English
Patent Info.: US-Patent-Appl-SN-09126859
Report No.(s): AD-D019446; No Copyright; Avail: Defense Technical Information Center (DTIC), Hardcopy

A control tab on a submarine or the like is angularly displaced by a remote control actuator system featuring a pair of shape-memory cables consisting of a superelastic actuating cable connected to the control tab and a force generating thermoelastic cable anchored to the submarine frame. A force transmitting lever interconnects the cables and is selectively locked by a releasable locking mechanism in a position holding the actuating cable fully stretched with the control tab displaced a maximum amount from its neutral position by the displacing force generated in the thermoelastic cable in response to heating thereof by electric current conducted therethrough.
DTIC
Actuators; Memory (Computers); Shapes

19990116480 Naval Air Warfare Center, Aircraft Div., Patuxent River, MD USA
A Comparison of Intelligent, Adaptive, and Nonlinear Flight Control Laws
Steinberg, Marc L.; Jun. 04, 1999; 12p; In English
Report No.(s): AD-A368768; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper compares in simulation six different nonlinear control laws for multi-axis control of a high performance aircraft. The control law approaches are fuzzy logic control, backstepping adaptive control, variable structure control, and indirect adaptive versions of Model Predictive Control and Dynamic Inversion. In addition, a more conventional scheduled dynamic inversion control law is used as a baseline. In some of the cases, a stochastic genetic algorithm was used to optimize fixed parameters during design. The control laws are demonstrated on a 6 Degree-of-Freedom simulation with nonlinear aerodynamic and engine models, actuator models with position and rate saturations, and turbulence. Simulation results include a variety of single and multiple axis maneuvers in normal operation and with failures or damage. The specific failure and damage cases that are examined include single and multiple lost surfaces, actuator hardovers, and an oscillating stabilator case. There are also substantial differences between the control law design and simulation models, which are used to demonstrate some robustness aspects of the different control laws.
DTIC
Flight Control; Control Systems Design; Degrees of Freedom; Dynamic Control

19990116631 Chinese Inst. of Engineers, Taipei, Taiwan, Province of China

Longitudinal Control of a Vehicle Platoon with Bounded Parametric Uncertainties

Huang, An-Chyau, National Taiwan Univ. of Science and Technology, Taiwan, Province of China; Chuang, Gee-Shen, National Taiwan Univ. of Science and Technology, Taiwan, Province of China; Chen, Yen John, National Taiwan Univ. of Science and Technology, Taiwan, Province of China; Journal of the Chinese Institute of Engineers, Special Issue: Mechanical Engineering; May 1999; ISSN 0253-3839; Volume 22, No. 3, pp. 365-374; In English

Contract(s)/Grant(s): NSC-86-2212-E011-026; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Longitudinal control laws are developed for a platoon of vehicles with bounded parametric uncertainties in an intelligent vehicle/highway system (IVHS). The platoon of vehicles is treated as a string of interconnected subsystems where control strategies are proposed. A novel sliding controller is derived to deal with uncertainties and disturbances in the individual vehicle model. to further improve platoon operation safety, asymmetric control laws are suggested so that intervehicle spacing regulation is performed in an asymmetric manner. Simulation results show the efficacy of proposed strategies.

Author

Longitudinal Control; Mathematical Models; Simulation; Controllers; Control Configured Vehicles; Armed Forces

19990116747 Defence Evaluation Research Agency, Farnborough, UK

Selected Control and Steering Issues for Non-Axisymmetric Missiles

Cleminson, J. R., Defence Evaluation Research Agency, UK; Lee, D. W., Defence Evaluation Research Agency, UK; Hodgson, J. A., Cambridge Control Ltd., UK; Hyde, R. A., Cambridge Control Ltd., UK; Missile Aerodynamics: Proceedings, 1999, pp. 2.1 - 2.18; In English; See also 19990116746; Copyright; Avail: Issuing Activity, Hardcopy

Three important features associated with the control of a precision-guided missile are a small autopilot effective time constant, a large acceleration advantage over the target, and good stability margins. This paper discusses how these features can be affected by the complexity of having an airframe that is non-axisymmetric. to begin with, a brief review of the traditional approach to missile autopilot design is given and some basic miss-distance sensitivities are illustrated. This helps to rationalise some of the motivations behind autopilot and steering design. Attention is then focused on how the various steering laws that may be required for nonaxisymmetric missiles can degrade the effective time constant, and how the potentially high levels of cross coupling inherent in such missiles can denude the transverse acceleration capability. Finally, the benefits of using a multivariable approach are discussed. In particular, a normalised coprime factor approach is considered for stability analysis, together with the so-called Loop Shaping Design Procedure (LSDP) for autopilot design.

Author

Automatic Pilots; Missile Design; Mathematical Models; Aircraft Control; Airframes; Steering

19990116748 Defence Evaluation Research Agency, Aerodynamic and Hydromechanics Centre, Bedford, UK

A Review of Lattice Control Research in the UK

Simpson, G. M., Defence Evaluation Research Agency, UK; Sadler, A. J., Defence Evaluation Research Agency, UK; Missile Aerodynamics: Proceedings, 1999, pp. 3.1 - 3.10; In English; See also 19990116746; Copyright; Avail: Issuing Activity, Hardcopy

The paper describes the motivation of lattice control research within Defense Evaluation and Research Agency (DERA). A brief over view of the DERA wind tunnel tests is given. Analysis of this data has indicated a number of advantages and disadvantages, including low hinge moments and improved lateral stability at the expense of high axial force. The progress, and problems encountered, in the development of a prediction method for lattice controls is also described. Finally, it will be shown how all these aspects of lattice controls research are an integral part of an international collaborative programme to predict, measure, and evaluate the aerodynamic performance of a generic tail controlled air-to-air missile (TCAAM) equipped with conventional and lattice controls.

Author

Wind Tunnel Tests; Lateral Stability; Aerodynamic Characteristics; Air to Air Missiles; Control Theory

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tubes; and aircraft engine test stands.

19990109636 **Institute for Human Factors TNO, Soesterberg, Netherlands**

The Use of Simulators for Training and Instruction *Interim Report Het gebruik van simulatoren voor training en instructie*

Verstegen, D. M. L., Institute for Human Factors TNO, Netherlands; Barnard, Y. F., Institute for Human Factors TNO, Netherlands; van Rooij, J. C. G. M., Institute for Human Factors TNO, Netherlands; Apr. 12, 1999; 64p; In English

Contracts(s)/Grants(s): B98-052; TNO Proj. 730.1

Report No.(s): TD-99-0029; TM-99-B0003; Copyright; Avail: Issuing Activity, Hardcopy

Advanced Learning Systems, such as simulators, have great potential for education. Simulators can provide opportunities for training when learning tasks on the real system is impossible, too dangerous or too expensive. Furthermore, it is possible to build in instructional facilities, e.g. to provide feedback and to register performance (automatically), which are usually not available on the real system. The difficulty level of exercises can be controlled and adapted to the needs of individual students. The current use of training simulators is described, in the form of an analysis of the results of field visits to 39 military training simulators. The results show that the possibilities of simulators are at present not used to their full extent. Especially facilities for instructor support, for feedback, assessment and performance registration, are often poor or lacking. Apparently, not much attention and resources are spent on the design of instructional facilities. It is argued that specifications for training simulators should be derived from the training objectives it should cover, i.e. the tasks that will be trained with it. Issues that should be addressed include: simulator coverage, integration in overall training, adaptation to target groups of trainees and to the needs of individual trainees, instruction, guidance and feedback, assessment of trainees, quality assurance and evaluation of training, adaptation of training and/or scenarios, instructor support and lay down specifications and the specification process. Further research will be oriented towards methodologies to develop training simulator specifications.

Author

Training Simulators; Learning; Education; Training Evaluation

19990109651 **Institute for Human Factors TNO, Soesterberg, Netherlands**

Effects of Asymmetric Delays on Task Performance in Networked Simulators *Interim Report Effecten van Asymmetrische Vertragingen op de Taakprestatie in Genetwerkte Simulatoren*

deVries, S. C., Institute for Human Factors TNO, Netherlands; Kappe, B., Institute for Human Factors TNO, Netherlands; Aug. 19, 1999; 42p; In English

Contracts(s)/Grants(s): A96/KL/354; TNO Proj. 730.3

Report No.(s): TD-99-0333; TNO-TM-99-A056; Copyright; Avail: Issuing Activity, Hardcopy

Distributed Interactive Simulation (DIS) is a collection of protocols used to connect various simulators. DIS is not free of complications because those simulators may be quite heterogeneous and geographically dispersed. Important are the effects of delays, which are encountered in several ways in the context of DIS. Also notable are the effects of the low update rate. A preceding experiment examined how the effects of delays within and between simulators influenced the group performance resulting in guidelines which specified maximum allowable delays. The current experiment was performed to answer questions around non-linear interactions between internal and external delays found in the preceding experiment. A consequence of these interactions might be that the performance of combinations of fast and slow simulators could be disproportionally determined by the level of the slower simulators. Additionally, using an improved version of the experiment, the implications of a mathematical model were studied. This study suggested that a certain amount of internal delay may be beneficial in the presence of external delays. The results of the experiment showed that the performance of a heterogeneous ensemble of simulators is not worse than the performance of a homogeneous ensemble with comparable internal delays. All performance measures depended linearly on the delay values and no interaction between the factors internal and external delay was found. The report concludes with a few modified guidelines.

Author

Asymmetry; Distributed Interactive Simulation; Mathematical Models; Simulators

19990109657 **Institute for Human Factors TNO, Soesterberg, Netherlands**

The Specification of Training Simulators and Other Advanced Training Means *Final Report De Specificatie van Geavanceerde Onderwijsleermiddelen*

Verstegen, D. M. L., Institute for Human Factors TNO, Netherlands; Barnard, Y. F., Institute for Human Factors TNO, Netherlands; vanRooij, J. C. G. M., Institute for Human Factors TNO, Netherlands; Jun. 07, 1999; 42p; In Dutch

Contract(s)/Grant(s): A98/KL/368; TNO Proj. 730.3
Report No.(s): TD-99-0050; TNO-TM-99-A044; Copyright; Avail: Issuing Activity, Hardcopy

More and more the Royal Netherlands Army uses advanced training means, such as Computer Based Training, simulations and simulators. The specification, development and/or acquisition of these training systems is, however, a bottleneck. Existing procedures and guidelines are not specifically oriented toward these advanced training system, and do not offer sufficient support in this area. The goal of this project is to identify suitable methods and tools and to integrate them in the organizational structure and the current acquisition procedures. This report describes the results of the first phase of the project: the current acquisition process is analysed and problems are identified. Subsequently a number of existing methods and tools for support in this area are described and evaluated: MASTER, BOOT, COMAID, ELSTAR (all results of TNO projects), the commercial software package Designer's Edge and GOOS, the tool that is currently used by the Royal Netherlands Army to develop syllabi. None of these methods and tools fulfills all the criteria. They offer support for specific domains or for parts of the acquisition process, but they are still isolated and are -except for GOOS- not yet used by the Royal Netherlands Army. In the subsequent workpackages of this project we will try to integrate some of these methods and tools, and to combine their strengths to provide sufficient support for the specification and acquisition of advanced training means. At this moment the lack of support is most evident in the first phase of the acquisition process, where a needs statement has to be written and a first estimation of the costs has to be made in order to claim budget. Therefore, we will focus on this phase initially.
Author
Training Simulators; Specifications; Education; Applications Programs (Computers)

19990110470 NYMA, Inc., Brook Park, OH USA
Flow Quality Measurements in an Aerodynamic Model of NASA Lewis' Icing Research Tunnel *Final Report*
Canacci, Victor A., NYMA, Inc., USA; Gonsalez, Jose C., NYMA, Inc., USA; January 1999; 20p; In English; 31st; Joint Propulsion, 10-12 Jul. 1995, San Diego, CA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): NAS3-27186; RTOP 523-91-13
Report No.(s): NASA/CR-1999-202353; E-10790; NAS 1.26:202353; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

As part of an on-going effort to improve the aerodynamic flow characteristics of the Icing Research Tunnel (IRT), a C, C, modular scale model of the facility was fabricated. This 1/10th-scale model was used to gain further understanding of the C C, flow characteristics in the IRT. The model was outfitted with instrumentation and data acquisition systems to determine pressures, velocities, and flow angles in the settling chamber and test section. Parametric flow quality studies involving L, the insertion and removal of a model of the IRT's distinctive heat exchanger (cooler) and/or of a honeycomb in the settling chamber were performed. These experiments illustrate the resulting improvement or degradation in flow quality.
Author
Aerodynamic Characteristics; Honeycomb Structures; Ice Formation; Heat Exchangers; Flow Characteristics; Degradation; Coolers

19990110575 NASA Ames Research Center, Moffett Field, CA USA
Overview of the NASA AMES-Dryden Integrated Test Facility
Mackall, Dale, NASA Ames Research Center, USA; McBride, David, NASA Ames Research Center, USA; Cohen, Dorothea, NASA Ames Research Center, USA; May 1990; 17p; In English; 36th ASD/TMD Proceedings, 7-10 May 1990, Denver, CO, USA
Contract(s)/Grant(s): RTOP 505-68-27
Report No.(s): NASA/TM-1999-101720; NAS 1.15:101720; H-1596; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Integrated Test Facility (ITF), being built at the NASA Ames Research Center's Dryden Flight Research Facility (ADFRF), will provide new real-time test capabilities for emerging research aircraft. An overview of the ITF and the real-time systems being developed to operate this unique facility are outlined in this paper. The ITF will reduce flight test risk by minimizing the difference between the flight- and ground-test environments. The ground-test environment is provided by combining real-time flight simulation with the actual aircraft. The generic capabilities of the ITF real-time systems, the real-time data recording, and the remotely augmented vehicle (RAV) monitoring system will be discussed. The benefits of applying simulation to aircraft-in-the-loop testing and RAV monitoring system capabilities to the X-29A flight research program will also be discussed.
Author
Computerized Simulation; Test Facilities; Data Recording; Ground Tests; Flight Simulators; Flight Simulation; X-29 Aircraft; Real Time Operation

19990110641 NASA Lewis Research Center, Cleveland, OH USA

LeRC NATR Free-Jet Development

Long–Davis, M., NASA Lewis Research Center, USA; Cooper, B. A., NASA Lewis Research Center, USA; First NASA/Industry High Speed Research Program Nozzle Symposium; September 1999, pp. 36-1 - 36-23; In English; See also 19990110605; No Copyright; Avail: CASI: A03, Hardcopy; A10, Microfiche

The Nozzle Acoustic Test Rig (NATR) was developed to provide additional test capabilities at Lewis needed to meet HSR program goals. The NATR is a large free-jet facility (free-jet diameter = 53 in.) with a design Mach number of 0.3. It is located inside a geodesic dome, adjacent to the existing Powered Lift Facility (PLF). The NATR allows nozzle concepts to be acoustically assessed for far-field (approximately 50 feet) noise characteristics under conditions simulating forward flight. An ejector concept was identified as a means of supplying the required airflow for this free-jet facility. The primary stream is supplied through a circular array of choked nozzles and the resulting low pressure in the constant, annular- area mixing section causes a "pumping" action that entrains the secondary stream. The mixed flow expands through an annular diffuser and into a plenum chamber. Once inside the plenum, the flow passes over a honeycomb/screen combination intended to remove large disturbances and provide uniform flow. The flow accelerates through an elliptical contraction section where it achieves a free-jet Mach number of up to 0.3.

Author

Noise Measurement; Simulation; Research Facilities; Fabrication; Honeycomb Structures; Air Flow

19990111450 Kyushu Univ., Faculty of Engineering, Fukuoka, Japan

Technology Reports of Kyushu University, Volume 71

Nov. 06, 1998; ISSN 0023-2718; 56p; In Japanese; See also 19990111451 through 19990111452; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Contents include the following: A study of the catalytically stabilized thermal reactor. Supersonic combustion wind tunnel facility.

CASI

Research; Catalytic Activity; Supersonic Combustion

19990111452 Kyushu Univ., Faculty of Engineering, Fukuoka, Japan

Supersonic Combustion Wind Tunnel Facility

Inokuchi, Yuzo, Kyushu Univ., Japan; Sumi, Takahiro, Kyushu Univ., Japan; Mito, Ryousuke, Kyushu Univ., Japan; Murakami, Tsutomu, Kyushu Univ., Japan; Gonda, Hiroyuki, Kyushu Univ., Japan; Matsumoto, Kentaro, Kyushu Univ., Japan; Yamasaki, Nobuhiko, Kyushu Univ., Japan; Namba, Masanobu, Kyushu Univ., Japan; Technology Reports of Kyushu University; Nov. 06, 1998; Volume 71, No. 6, pp. 567-574; In Japanese; See also 19990111450; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The paper presents an overview, design strategy, details of components and performance of the newly built supersonic combustion wind tunnel. This blowdown type wind tunnel has a vitiation heater to simulate the scramjet engine combustor. Total temperature, total pressure and static pressure measured at the test section are 1300 K, 0.04 MPa, and 0.04 MPa, respectively. The mach number calculated from the measured total/static pressure ratio is 2.0, which equals exactly to the design value. Non-uniformities of measured pressure and temperature are within 5% of their space-mean value, which can be regarded as uniform enough for the supersonic combustion experimental research. The wind tunnel is capable of realizing a steady state operation of 10 seconds required for PLIF measurement of supersonic combustion field.

Author

Blowdown Wind Tunnels; Design Analysis; Performance Prediction

19990111544 University of Southern Illinois, Carbondale, IL USA

Planning for New Primary Airports in the USA: A Survey of Metropolitan Planning Organizations

NewMeyer, David A., University of Southern Illinois, USA; Journal of Air Transportation World Wide; 1999; Volume 4, No. 2, pp. 49-65; In English; See also 19990111540; Copyright; Avail: Issuing Activity, Hardcopy

Airport congestion at primary airports in major metropolitan areas was analyzed in a report prepared by the Transportation Research Board (TRB) in 1990. Taking the top twenty-three most congested airports from this study, a questionnaire was prepared and sent to the metropolitan planning organizations (MPOS) for twenty of the twenty-three metropolitan areas represented in the TRB study. The questionnaire focused on the role of the MPOs in planning for new primary airports in the USA, including questions about the status of the most recent MPO airport system plan, whether or not the latest plan recommends a new primary airport, and whether or not any other entities in the MPO areas are recommending new primary airports. The results indicated that

44.4 percent of the eighteen respondent MPOs have airport system plans that are five years old or older. Also, only two of the respondent MPOs have recommended a new primary airport in their latest regional airport system plan and only one of these two is a common recommendation in the Federal Aviation Administration's National Plan of Integrated Airport System.
Author
Air Traffic; Airports; Airport Planning

19990111547 Directorate General of Civil Aviation, The Hague, Netherlands
The Integrated Airport Competition Model, 1998
Veldhuis, J., Directorate General of Civil Aviation, Netherlands; Essers, L., Directorate General of Civil Aviation, Netherlands; Bakker, D., Hague Consulting Group, Netherlands; Cohn, N., Hague Consulting Group, Netherlands; Kroes, E., Hague Consulting Group, Netherlands; Journal of Air Transportation World Wide; 1999; Volume 4, No. 2, pp. 100-120; In English; See also 19990111540; Copyright; Avail: Issuing Activity, Hardcopy

This paper addresses recent model development by the Directorate General of Civil Aviation (DGCA) and Hague Consulting Group (HCG) concerning long-distance travel. Long-distance travel demand is growing very quickly and raising a great deal of economic and policy issues. There is increasing competition among the main Western European airports, and smaller, regional airports are fighting for market share. New modes of transport, such as high speed rail, are also coming into the picture and affect the mode split for medium distance transport within Europe. Developments such as these are demanding the attention of policy makers and a tool is required for their analysis. For DGCA, Hague Consulting Group has developed a model system to provide answers to the policy questions posed by these expected trends, and to identify areas where policy makers can influence the traveller choices. The development of this model system, the Integrated Airport Competition Model/integraal Luchthaven Competitie Model (ILCM), began in 1992. Since that time the sub-models, input data and user interface have been expanded, updated and improved. HCG and DGCA have transformed the ILCM from a prototype into an operational forecasting tool.
Author
Airports; Competition; Models

19990111718 General Accounting Office, Resources, Community and Economic Development Div., Washington, DC USA
General Aviation Airports: Oversight and Funding
Anderson, John H., Jr; Jun. 09, 1999; 12p; In English; Testimony Before the Subcommittee on Aviation, Committee on Transportation and Infrastructure, House of Representatives.
Report No.(s): AD-A364752; GAO/T-RCED-99-214; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

All Federal Aviation Administration (FAA) field offices rely primarily on third-party complaints to identify airports' noncompliance with allowable uses. Only 4 of FAA's 23 field offices monitor general aviation airports to ensure that they comply with federal requirements to use airport land only for airport purposes. to do this, these four field offices rely on the airports' self-certifications that they are in compliance. Relying on airports' self-certifications and third-party complaints is not sufficient. Without monitoring, airports' unauthorized use of land has gone uncorrected-in some cases for over a decade. For example, airport land has been inappropriately used for mobile home parks, little league baseball fields, dog pounds, duck-hunting blinds, and city police, fire, and vehicle maintenance facilities. Unauthorized land use has resulted in the loss or diversion of millions of dollars in airport revenues from general aviation airports, which are typically owned by local governments. In some cases, increased risks to aviation safety also resulted. For example, FAA determined that birds attracted by an unauthorized landfill on an airport posed a possible danger to aircraft. If and when FAA becomes aware that an airport is not complying, it has a variety of statutory and administrative alternatives. However, FAA has generally chosen not to use them, preferring to address noncompliance through negotiation and settlement, an approach that has not always been effective in resolving airports' noncompliance. Our report included recommendations designed to address these problems.
DTIC
Airports; Federal Budgets; Grants; Investments

19990116372 NASA Langley Research Center, Hampton, VA USA
Inviscid Design of Hypersonic Wind Tunnel Nozzles for a Real Gas
Korte, J. J., NASA Langley Research Center, USA; [2000]; 10p; In English; 38th; Aerospace Sciences, 10-13 Jan. 2000, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): AIAA Paper 2000-0677; Copyright Waived; Avail: CASI; A02, Hardcopy; A01, Microfiche

A straightforward procedure has been developed to quickly determine an inviscid design of a hypersonic wind tunnel nozzle when the test crash is both calorically and thermally imperfect. This real gas procedure divides the nozzle into four distinct parts: subsonic, throat to conical, conical, and turning flow regions. The design process is greatly simplified by treating the imperfect

gas effects only in the source flow region. This simplification can be justified for a large class of hypersonic wind tunnel nozzle design problems. The final nozzle design is obtained either by doing a classical boundary layer correction or by using this inviscid design as the starting point for a viscous design optimization based on computational fluid dynamics. An example of a real gas nozzle design is used to illustrate the method. The accuracy of the real gas design procedure is shown to compare favorably with an ideal gas design based on computed flow field solutions.
Author
Nozzle Design; Wind Tunnel Nozzles; Flow Distribution; Inviscid Flow; Real Gases

19990116787 California Univ., Dept. of Mechanical and Aeronautical Engineering, Davis, CA USA
An Analytical Comparison of the Fidelity of "Large Motion" Versus "Small Motion" Flight Simulators in a Rotorcraft Side-Step Task
Hess, Ronald A., California Univ., USA; [1999]; 11p; In English
Contract(s)/Grant(s): NCC2-5238; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper presents an analytical and experimental methodology for studying flight simulator fidelity. The task was a rotorcraft bob-up/down maneuver in which vertical acceleration constituted the motion cue. The task considered here is aside-step maneuver that differs from the bob-up one important way: both roll and lateral acceleration cues are available to the pilot. It has been communicated to the author that in some Verticle Motion Simulator (VMS) studies, the lateral acceleration cue has been found to be the most important. It is of some interest to hypothesize how this motion cue associated with "outer-loop" lateral translation fits into the modeling procedure where only "inner-loop " motion cues were considered. This Note is an attempt at formulating such an hypothesis and analytically comparing a large-motion simulator, e.g., the VMS, with a small-motion simulator, e.g., a hexapod.
Derived from text
Rotary Wing Aircraft; Mathematical Models; Computerized Simulation; Vertical Motion Simulators

10
ASTRONAUTICS

Includes astronautics (general); astrodynamics; ground support systems and facilities (space); launch vehicles and space vehicles; space transportation; space communications, spacecraft communications, command and tracking; spacecraft design, testing and performance; spacecraft instrumentation; and spacecraft propulsion and power.

19990061890 NASA Marshall Space Flight Center, Huntsville, AL USA
RL-10 Based Combined Cycle For A Small Reusable Single-Stage-to-Orbit Launcher
Balepin, Vladimir, MSE Technology Applications, Inc., USA; Price, John, NASA Marshall Space Flight Center, USA; Filipenco, Victor, United Technologies Research Center, USA; 1999; In English; 14th; Airbreathing Engines Symposium, 5-10 Sep. 1999, Florence, Italy
Contract(s)/Grant(s): DE-AC22-96EW96405; Copyright; Avail: Issuing Activity, Hardcopy

This paper discusses a new application of the combined propulsion known as the KLIN(TM) cycle, consisting of a thermally integrated deeply cooled turbojet (DCTJ) and liquid rocket engine (LRE). If based on the RL10 rocket engine family, the KLIN (TM) cycle makes a small single-stage-to-orbit (SSTO) reusable launcher feasible and economically very attractive. Considered in this paper are the concept and parameters of a small SSTO reusable launch vehicle (RLV) powered by the KLIN (TM) cycle (sSSTO(TM)) launcher. Also discussed are the benefits of the small launcher, the reusability, and the combined cycle application. This paper shows the significant reduction of the gross take off weight (GTOW) and dry weight of the KLIN(TM) cycle-powered launcher compared to an all-rocket launcher.
Author
RL-10 Engines; Single Stage to Orbit Vehicles; Air Breathing Engines; Turbojet Engines; Liquid Air Cycle Engines; Jet Propulsion; Rocket Launchers; Combined Cycle Power Generation

19990111698 NASA Marshall Space Flight Center, Huntsville, AL USA
Design of a Low Cost Avionics System for Launch Vehicles
Crawford, Kevin, NASA Marshall Space Flight Center, USA; Wallace, Shawn, NASA Marshall Space Flight Center, USA; Jan. 28, 1998; In English; Digital Avionics, 31 Oct. - 6 Nov. 1998, Seattle, WA, USA; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Marshall Space Flight Center has long been one of the leaders in development of propulsion systems. Due to current launch vehicle costs, Marshall Space Flight Centers (MSFC) Advanced Space Transportation Program (ASTP) office has emphasized the development of low cost launch vehicles. The Bantam launch vehicle is one of the primary programs that has low cost as a requirement. One of the driving factors for a low cost launch vehicle is a low cost avionics system. This paper will summarize MSFC's Astrionics Laboratories efforts in designing a low cost avionics system. MSFC has done Phase A avionics system design and has been working with various contractors on a Phase B preliminary avionics design. Deriving the major requirements, trade studies and cost drivers are some of the topics to be discussed.
Author
Systems Engineering; Avionics; Launch Vehicles; Aircraft Design

19990113195 NASA Marshall Space Flight Center, Huntsville, AL USA
NASA X-34 Technology in Motion
Beech, Geoffrey, NASA Marshall Space Flight Center, USA; Chandler, Kristie, NASA Marshall Space Flight Center, USA; [1997]; 1p; In English; Deneb Simulation, 29 Sep. - 3 Oct. 1997, Troy, MI, USA; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

The X-34 technology development program is a joint industry/government project to develop, test, and operate a small, fully-reusable hypersonic flight vehicle. The objective is to demonstrate key technologies and operating concepts applicable to future reusable launch vehicles. Integrated in the vehicle are various systems to assure successful completion of mission objectives, including the Main Propulsion System (MPS). NASA-Marshall Space Flight Center (MSFC) is responsible for developing the X-34's MPS including the design and complete build package for the propulsion system components. The X-34 will be powered by the Fastrac Engine, which is currently in design and development at NASA-MSFC. Fastrac is a single-stage main engine, which burns a mixture of liquid oxygen (LOX) and kerosene(RP-1). The interface between the MPS and Fastrac engine are critical for proper system operation and technologies applicable to future reusable launch vehicles. Deneb's IGRIP software package with the Dynamic analysis option provided a key tool for conducting studies critical to this interface as well as a mechanism to drive the design of the LOX and RP-1 feedlines. Kinematic models were created for the Fastrac Engine and the feedlines for various design concepts. Based on the kinematic simulation within Envision, design and joint limits were verified and system interference controlled. It was also critical to the program to evaluate the effect of dynamic loads visually, providing a verification tool for dynamic analysis and in some cases uncovering areas that had not been considered. Deneb's software put the X-34 technology in motion and has been a key factor in facilitating the strenuous design schedule.
Author
X-34 Reusable Launch Vehicle; Software Engineering; Design Analysis; Aircraft Industry; Computer Aided Design

19990116842 NASA Marshall Space Flight Center, Huntsville, AL USA
NASA's Reusable Launch Vehicle Technologies: A Composite Materials Overview
Clinton, R. G., Jr., NASA Marshall Space Flight Center, USA; Cook, Steve, NASA Marshall Space Flight Center, USA; Effinger, Mike, NASA Marshall Space Flight Center, USA; Smith, Dennis, NASA Marshall Space Flight Center, USA; Swint, Shayne, NASA Marshall Space Flight Center, USA; [1999]; 21p; In English; 23rd; Composites, Materials, and Structure, 26-28 Jan. 1999, Cocoa Beach, FL, USA; Sponsored by NASA Marshall Space Flight Center, USA; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A materials overview of the NASA's Earth-to-Orbit Space Transportation Program is presented. The topics discussed are: Earth-to-Orbit Goals and Challenges; Space Transportation Program Structure; Generations of Reusable Launch Vehicles; Space Transportation Derived Requirements; X 34 Demonstrator; Fastrac Engine System; Airframe Systems; Propulsion Systems; Cryotank Structures; Advanced Materials, Fabrication, Manufacturing, & Assembly; Hot and Cooled Airframe Structures; Ceramic Matrix Composites; Ultra-High Temp Polymer Matrix Composites; Metal Matrix Composites; and PMC Lines Ducts and Valves.
CASI
Space Transportation; Reusable Launch Vehicles; Airframes; Propulsion System Configurations; Polymer Matrix Composites; Ceramic Matrix Composites; Metal Matrix Composites

19990118570 National Aerospace Lab., Tokyo, Japan
Ground Effects Obtained from Flight Tests of ALFLEX
Okada, N., National Aerospace Lab., Japan; Suito, T., National Aerospace Lab., Japan; December 1997; 20p; In Japanese
Report No.(s): PB99--127714; NAL-TR-1344; Copyright Waived; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The ALFLEX (Automatic Landing FLight EXperiment) vehicle is a 37% scale model of a future reentry vehicle, HOPE (H-II Orbiting Plane), and was developed for investigating the horizontal landing capability of the HOPE. The flight experiment was carried out at the Woomera Airfield in South Australia in 1996. Landing trials of the ALFLEX were realized by releasing the vehicle hung by a cable from a helicopter. After the release, the vehicle autonomously made path capture, equilibrium gliding on a -30 deg flight path, flare and touch-down on a runway. During the development phase, ground effects had been considered as key issues that affect the landing performance, and wind tunnel tests for predicting the ground effects had been carried out. For the purpose of validating the potential of the wind tunnel data for future designs, ground effect characteristics derived from the flight data and comparison with the wind tunnel data are given in this paper.
NTIS

Hope Aerospace Plane; Reentry Vehicles; Ground Effect (Aerodynamics); Flight Tests; Automatic Landing Control; Wind Tunnel Tests; Scale Models; Aircraft Landing

19990116068 NASA Goddard Space Flight Center, Greenbelt, MD USA

Development and Testing of Automatically Generated ACS Flight Software for the MAP Spacecraft

ODonnell, James R., Jr., NASA Goddard Space Flight Center, USA; McComas, David C., NASA Goddard Space Flight Center, USA; Andrews, Stephen F., NASA Goddard Space Flight Center, USA; Oct. 08, 1998; 1p; In English; 14th; Space Flight Dynamics, USA; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

By integrating the attitude determination and control system (ACS) analysis and design, flight software development, and flight software testing processes, it is possible to improve the overall spacecraft development cycle, as well as allow for more thorough software testing. One of the ways to achieve this integration is to use code-generation tools to automatically generate components of the ACS flight software directly from a high-fidelity (HiFi) simulation. In the development of the Microwave Anisotropy Probe (MAP) spacecraft, currently underway at the NASA Goddard Space Flight Center, approximately 1/3 of the ACS flight software was automatically generated. In this paper, we will examine each phase of the ACS subsystem and flight software design life cycle: analysis, design, and testing. In the analysis phase, we scoped how much software we would automatically generate and created the initial interface. The design phase included parallel development of the HiFi simulation and the hand-coded flight software components. Everything came together in the test phase, in which the flight software was tested, using results from the HiFi simulation as one of the bases of comparison for testing. Because parts of the spacecraft HiFi simulation were converted into flight software, more care needed to be put into its development and configuration control to support both the HiFi simulation and flight software. The components of the HiFi simulation from which code was generated needed to be designed based on the fact that they would become flight software. This process involved such considerations as protecting against mathematical exceptions, using acceptable module and parameter naming conventions, and using an input/output interface compatible with the rest of the flight software. Maintaining good configuration control was an issue for the HiFi simulation and the flight software, and a way to track the two systems was devised. Finally, an integrated test approach was devised to support flight software testing at both the unit- and build-test levels using the HiFi simulation to generate data for performance verification. Another benefit of the simulation and code-generation application used on the MAP project is that it supported bringing flight software and test data into the HiFi simulation environment. It was possible to integrate parts of the hand-coded flight software into the HiFi simulation, and also possible to import flight software test data for comparison and performance verification. This capability was used to incorporate the flight software Kalman filter into the HiFi simulation. This enabled us to greatly increase the amount of testing that could be done on the filter, because we could exert a greater degree of control over the software-only simulation than over the flight software test environment. Also, since the simulation could be used to run the Kalman filter faster than real time, our testing efficiency was greatly increased. We will conclude our discussion with a summary of the lessons learned thus far using automatically- generated code for the MAP project, and the spacecraft status as we work towards our scheduled launch in the year 2000.
Author

Computer Programming; Computerized Simulation; Flight Control; Program Verification (Computers); Software Reliability; Computer Systems Performance; Software Development Tools

19990110107 Naval Health Research Center, Toxicology Detachment, San Diego, CA USA

The Neurobehavioral Toxicity of JP-8, JP-5 and JP-4 Jet Fuels

Nordholm, A. F., Naval Health Research Center, USA; Ritchie, G. D., Geo-Centers, Inc., USA; Malcolm, W., ManTech Environmental Technology, Inc., USA; Carpenter, R. L., Naval Health Research Center, USA; Rossi, John, III, Naval Health Research Center, USA; Still, K. R., Naval Health Research Center, USA; JANNAF 28th Propellant Development and Characterization Subcommittee and 17th Safety and Environmental Protection Subcommittee Joint Meeting; April 1999; Volume 1, pp. 197-213; In English; See also 19990110087; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia,

MD 21044-3200 HC, Hardcopy

(U) Groups of Sprague-Dawley rats (n = 32) were exposed by whole body inhalation methods to JP-8 (1.0 mg/L +/- 10%) or JP-5 (1.2 mg/L +/- 10%) vapor for 6 hr/day, 5 days/wk, for 6 wk, to JP-4 (2.0 mg/L +/- 10%; n = 16) vapor for 6 hr/day for 14 consecutive days; or to appropriate room air control conditions. The concentrations were selected to represent real world vapor exposures that might be experienced by the operational military. Following conclusion of the exposures, rats were rested for 14-65 days, then were evaluated for persisting neurobehavioral deficits with a battery of tests selected from the Neurobehavioral Toxicity Assessment Battery (NTAB) for their presumed ability to identify, performance deficits similar to those previously identified in chronically exposed European jet engine workers. NTAB tests utilized included: Forelimb Grip Strength (FGS), evaluating muscle strength; General Locomotor Activity (GLA); Forced Treadmill (FT), measuring physical fatigue; Tail Flick Response (TFR), evaluating nociception; Acoustic Startle Response/Prepulse Inhibition (ASR/PPI), quantifying auditory brainstem function and inhibition; Passive Avoidance (PA), evaluating short-term memory; Porsolt Forced Swim test (PFST), measuring emotional depression; Morris Water Maze (MWM), quantifying spatial localization and short term memory; Appetitive Reinforcer Approach Sensitization (ARAS), evaluating central nervous system (CNS) sensitization and dopaminergic function, and Conspecific Approach (CA), evaluating social behavior. Following sacrifice, regional CNS tissues were evaluated for changes, from air controls, in levels of neurotransmitters and major metabolites.

Author

JP-4 Jet Fuel; JP-5 Jet Fuel; JP-8 Jet Fuel; Hydrocarbons; Toxicity; Military Technology

19990116751 Defence and Evaluation Research Agency, Weapons Propulsion and Performance Group, Pyestock, UK

Interaction of Missile Propulsion and Aerodynamics

Buchanan, Cecil R., Defence and Evaluation Research Agency, UK; Gemmill, Andrew J. T., Defence and Evaluation Research Agency, UK; Martin, Peter G., Defence Evaluation Research Agency, UK; Missile Aerodynamics: Proceedings; 1999, pp. 6.1 - 6.8; In English; See also 19990116746; Copyright; Avail: Issuing Activity, Hardcopy

Some aspects of propulsion integration issues for ramjet powered missiles are outlined in this paper. The benefits of ramjet propulsion in the Mach 2-4 range over other types of airbreathing propulsion and rocket propulsion are well known. Compared with solid rocket motors, ramjet engines offer a much higher specific impulse and the capability of thrust management, enabling longer standoff ranges and more flexible operation. An overview of the ramjet engine cycle is given, highlighting engine/intake matching issues. This is followed by a performance comparison between a generic ramjet and a solid rocket powered missile (the air-to-air configuration is examined by way of example in this paper). As well as overall performance, intake integration and missile steering issues are considered. A description of a wind tunnel test model, intake design and tunnel testing is given. The effects of design Mach number and side-wall removal have been investigated for twin ventral rectangular intake configurations. These tests were aimed at optimising performance at different flight conditions and improving tolerance to yawed flight. The impact of the alternative intake designs on missile performance is discussed.

Author

Ramjet Engines; Air to Air Missiles; Jet Propulsion; Wind Tunnel Tests; Supersonic Speed; Aerodynamics

11
CHEMISTRY AND MATERIALS

Includes chemistry and materials (general); composite materials; inorganic and physical chemistry; metallic materials; nonmetallic materials; propellants and fuels; and materials processing.

19990110679 NASA Marshall Space Flight Center, Huntsville, AL USA

Key Issues for Aerospace Applications of Ceramic Matrix Composites

Clinton, R. G., Jr., NASA Marshall Space Flight Center, USA; Levine, S. R., NASA Lewis Research Center, USA; [1998]; 1p; In English; Pacific Coast Regional Meeting, 22-24 Oct. 1998, Irvine, CA, USA; Sponsored by American Ceramic Society, USA; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Ceramic matrix composites (CMC) offer significant advantages for future aerospace applications including turbine engine and liquid rocket engine components, thermal protection systems, and "hot structures". Key characteristics which establish ceramic matrix composites as attractive and often enabling choices are strength retention at high temperatures and reduced weight relative to currently used metallics. However, due to the immaturity of this class of materials which is further compounded by the lack of experience with CMC's in the aerospace industry, there are significant challenges involved in the development and implementation of ceramic matrix composites into aerospace systems. Some of the more critical challenges are attachment and load transfer methodologies; manufacturing techniques, particularly scale up to large and thick section components; operational

environment resistance; damage tolerance; durability; repair techniques; reproducibility; database availability; and the lack of validated design and analysis tools. The presentation will examine the technical issues confronting the application of ceramic matrix composites to aerospace systems and identify the key material systems having potential for substantial payoff relative to the primary requirements of light weight and reduced cost for future systems. Current programs and future research opportunities will be described in the presentation which will focus on materials and processes issues.

Author

Aerospace Engineering; Structural Engineering; Ceramic Matrix Composites; Composite Structures; Engine Parts; Turbine Engines; Liquid Propellant Rocket Engines

19990111471 NASA Glenn Research Center, Cleveland, OH USA

Aerothermo-Structural Analysis of Low Cost Composite Nozzle/Inlet Components

Shivakumar, Kuwigai, North Carolina Agricultural and Technical State Univ., USA; Challa, Preeli, North Carolina Agricultural and Technical State Univ., USA; Snee, Dave, Tuskegee Inst., USA; Reddy, D., NASA Glenn Research Center, USA; HBCUs/OMUs Research Conference Agenda and Abstracts; August 1999, pp. 25; In English; See also 19990111455; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

This research is a cooperative effort among the Turbomachinery and Propulsion Division of NASA Glenn, CCMR of NC A&T State University, and the Tuskegee University. The NC A&T is the lead center and Tuskegee University is the participating institution. Objectives of the research were to develop an integrated aerodynamic, thermal and structural analysis code for design of aircraft engine components, such as, nozzles and inlets made of textile composites; conduct design studies on typical inlets for hypersonic transportation vehicles and setup standards test examples and finally manufacture a scaled down composite inlet. These objectives are accomplished through the following seven tasks: (1) identify the relevant public domain codes for all three types of analysis; (2) evaluate the codes for the accuracy of results and computational efficiency; (3) develop aero-thermal and thermal structural mapping algorithms; (4) integrate all the codes into one single code; (5) write a graphical user interface to improve the user friendliness of the code; (6) conduct test studies for rocket based combined-cycle engine inlet; and finally (7) fabricate a demonstration inlet model using textile preform composites. Tasks one, two and six are being pursued. Selected and evaluated NPARC for flow field analysis, CSTEM for in-depth thermal analysis of inlets and nozzles and FRAC3D for stress analysis. These codes have been independently verified for accuracy and performance. In addition, graphical user interface based on micromechanics analysis for laminated as well as textile composites was developed. Demonstration of this code will be made at the conference. A rocket based combined cycle engine was selected for test studies. Flow field analysis of various inlet geometries were studied. Integration of codes is being continued. The codes developed are being applied to a candidate example of trailblazer engine proposed for space transportation. A successful development of the code will provide a simpler, faster and user-friendly tool for conducting design studies of aircraft and spacecraft engines, applicable in high speed civil transport and space missions.

Author

Aerothermodynamics; Aircraft Design; Algorithms; Composite Materials; Engine Parts; Micromechanics; Structural Analysis; Textiles; Thermal Analysis

19990114849 Office of Naval Research, Arlington, VA USA

Pulsed Detonation Phenomena for Propulsion

Roy, G. D., Office of Naval Research, USA; JANNAF Airbreathing Propulsion Subcommittee and 35th Combustion Subcommittee Meeting; December 1998; Volume 1; 12p; In English; See also 19990114846; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC, Hardcopy

Air breathing engines based on pulse detonation cycle offer the potential of higher cycle efficiency, better specific thrust and reduced fuel consumption. In some cases this can be achieved with no moving parts. The simplicity of the Pulse Detonation Engine (PDE) and its potential for scaling extrapolate to substantial reductions in development time, when compared to conventional turbine engines. Multi-tube detonation engines can offer the potential of fluidic thrust vectoring with low drag, and without external fins, a decisive advantage in high-speed missile propulsion. There has been considerable attention paid in the development of PDE worldwide by industry during the last several years. Though detonation has been treated extensively in the literature, no significant research has been undertaken to study the various scientific issues involved in utilizing this concept for propulsion. The Office of Naval Research (ONR) has initiated a research program in PDE, and also is in the process of starting a five-year Multidisciplinary University Research Initiative (MURI) beginning next year. The ongoing efforts focus on the numerical determination of the figure of merit of PDE, and to develop diagnostics that are particularly needed to determine the performance of PDES. Multi-cycle operation of single detonation tube has been performed, and the diagnostic tools developed

have been used in these experiments. Some of the recent accomplishments and the scope of the upcoming program are discussed in this paper.
Author
Detonation; Propulsion; Air Breathing Engines; Turbine Engines; Fuel Consumption

19990116722 NASA Lewis Research Center, Cleveland, OH USA
Pressure-Sensitive Paint Measurements on Surfaces with Non-Uniform Temperature
Bencic, Timothy J., NASA Lewis Research Center, USA; 1999; 10p; In English; 45th; Instrumentation, 2-6 May 1999, Albuquerque, NM, USA; Sponsored by Instrument Society of America, USA
Contract(s)/Grant(s): RTOP 519-20-53; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Pressure-sensitive paint (PSP) has become a useful tool to augment conventional pressure taps in measuring the surface pressure distribution of aerodynamic components in wind tunnel testing. While the PSP offers the advantage of a non-intrusive global mapping of the surface pressure, one prominent drawback to the accuracy of this technique is the inherent temperature sensitivity of the coating's luminescent intensity. A typical aerodynamic surface PSP test has relied on the coated surface to be both spatially and temporally isothermal, along with conventional instrumentation for an in situ calibration to generate the highest accuracy pressure mappings. In some tests however, spatial and temporal thermal gradients are generated by the nature of the test as in a blowing jet impinging on a surface. In these cases, the temperature variations on the painted surface must be accounted for in order to yield high accuracy and reliable data. A new temperature correction technique was developed at NASA Lewis to collapse a "family" of PSP calibration curves to a single intensity ratio versus pressure curve. This correction allows a streamlined procedure to be followed whether or not temperature information is used in the data reduction of the PSP. This paper explores the use of conventional instrumentation such as thermocouples and pressure taps along with temperature-sensitive paint (TSP) to correct for the thermal gradients that exist in aeropropulsion PSP tests. Temperature corrected PSP measurements for both a supersonic mixer ejector and jet cavity interaction tests are presented.
Author
Aerodynamics; Paints; Pressure Distribution; Pressure Measurement; Supersonic Jet Flow; Temperature Measurement

19990116848 Allied-Signal Engines, Phoenix, AZ USA
Advanced High Temperature Polymer Matrix Composites for Gas Turbine Engines Program Expansion *Final Report, 1 Dec. 1996 - 24 Aug. 1998*
Hanley, David, Allied-Signal Engines, USA; Carella, John, Allied-Signal Engines, USA; August 1999; 96p; In English; Original contains color illustrations
Contract(s)/Grant(s): NAS3-97003; RTOP 523-21-13
Report No.(s): NASA/CR-1999-208889; E-11634; NAS 1.26:208889; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This document, submitted by AlliedSignal Engines (AE), a division of AlliedSignal Aerospace Company, presents the program final report for the Advanced High Temperature Polymer Matrix Composites for Gas Turbine Engines Program Expansion in compliance with data requirements in the statement of work, Contract No. NAS3-97003. This document includes: 1 -Technical Summary: a) Component Design, b) Manufacturing Process Selection, c) Vendor Selection, and d) Testing Validation: 2-Program Conclusion and Perspective. Also, see the Appendix at the back of this report. This report covers the program accomplishments from December 1, 1996, to August 24, 1998. The Advanced High Temperature PMC's for Gas Turbine Engines Program Expansion was a one year long, five task technical effort aimed at designing, fabricating and testing a turbine engine component using NASA's high temperature resin system AMB-21. The fiber material chosen was graphite T650-35, 3K, 8HS with UC-309 sizing. The first four tasks included component design and manufacturing, process selection, vendor selection, component fabrication and validation testing. The final task involved monthly financial and technical reports.
Author
Polymer Matrix Composites; Gas Turbine Engines; Engine Parts; Manufacturing

19990110592 Department of Energy, Assistant Secretary for Energy Efficiency and Renewable Energy, Washington, DC USA
Implementation of alternative bio-based fuels in aviation: The Clean Airports Program
Shauck, M. E., Department of Energy, USA; Zanin, M. G., Department of Energy, USA; Dec. 31, 1997; 8p; In English; 3rd; Biomass Conference of the Americas, USA
Report No.(s): DE99-001104; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The Renewable Aviation Fuels Development Center at Baylor University in Waco, Texas, was designated, in March 1996, by the US Department of Energy (US DOE) as the national coordinator of the Clean Airports Program. This program, a spin-off

of the Clean Cities Program, was initiated to increase the use of alternative fuels in aviation. There are two major fuels used in aviation today, the current piston engine aviation gasoline, and the current turbine engine fuel. The environmental impact of each of these fuels is significant. Aviation Gasoline (100LL), currently used in the General Aviation piston engine fleet, contributes 100% of the emissions containing lead in the USA today. In the case of the turbine engine fuel (Jet fuel), there are two major environmental impacts to be considered: the local, in the vicinity of the airports, and the global impact on climate change. The Clean Airports Program was established to promote the use of clean burning fuels in order to achieve and maintain clean air at and in the vicinities of airports through the use of alternative fuel- powered air and ground transportation vehicles.
NTIS
Jet Engine Fuels; Environment Effects; Substitutes; Clean Fuels; Climate Change; Airports

19990116593 Department of Energy, Assistant Secretary for Energy Efficiency and Renewable Energy, Washington, DC USA
Certification of the Cessna 152 on 100% ethanol
Shauck, M. E., Department of Energy, USA; Zanin, M. G., Department of Energy, USA; Dec. 31, 1997; 6p; In English; Aerospace Congress '97, 1997, USA
Report No.(s): DE99-001105; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
In June 1996, the Renewable Aviation Fuels Development Center (RAFDC) at Baylor University in Waco, Texas, received a Supplemental Type Certificate (STC) for the use of 100% ethanol as a fuel for the Cessna 152, the most popular training aircraft in the world. This is the first certification granted by the Federal Aviation Administration (FAA) for a non-petroleum fuel. Certification of an aircraft on a new fuel requires a certification of the engine followed by a certification of the airframe/engine combination. This paper will describe the FAA airframe certification procedure, the tests required and their outcome using ethanol as an aviation fuel in a Cessna 152.
NTIS
Ethyl Alcohol; Aircraft Fuels; Substitutes; Certification

19990114848 General Applied Science Labs., Inc., Ronkonkoma, NY USA
Recombination Catalysts for Hypersonic Fuels
Chinitz, W., General Applied Science Labs., Inc., USA; JANNAF Airbreathing Propulsion Subcommittee and 35th Combustion Subcommittee Meeting; December 1998; Volume 1, pp. 9-22; In English; See also 19990114846
Contract(s)/Grant(s): NAS1-97067; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC, Hardcopy
The goal of commercially-viable access to space will require technologies that reduce propulsion system weight and complexity, while extracting maximum energy from the products of combustion. This work is directed toward developing effective nozzle recombination catalysts for the supersonic and hypersonic aeropropulsion engines used to provide such access to space. Effective nozzle recombination will significantly reduce nozzle length (hence, propulsion system weight) and reduce fuel requirements, further decreasing the vehicle's gross lift-off weight. Two such catalysts have been identified in this work, barium and antimony compounds, by developing chemical kinetic reaction mechanisms for these materials and determining the engine performance enhancement for a typical flight trajectory. Significant performance improvements are indicated, using only 2% (mole or mass) of these compounds in the combustor product gas.
Author
Aircraft Engines; Combustion Chambers; Hypersonics; Propulsion

19990116198 Department of Defense, Office of the Inspector General, Arlington, VA USA
Procuring Fuel and Ground Handling Services at Commercial Airports
Aug. 18, 1998; 37p; In English
Report No.(s): AD-A367863; IG/DOD-98-189; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy
DoD pilots purchase fuel from fixed-base operators at commercial airports using into-plane contracts, the aviation into-plane reimbursement card, or local purchase procedures. DoD also uses the aviation into-plane reimbursement card and local purchase procedures to obtain ground handling services at commercial airports. DoD used the aviation into-plane reimbursement card to procure $10.5 million of fuel from May 1, 1997, through April 30, 1998. The overall audit objective was to evaluate the management of and processes used to procure, store, and account for fuels to meet US European Command requirements for regional contingencies. The specific objective for this segment of the audit was to determine the most cost-effective acquisition strategy for procuring aviation fuel and to determine whether prices for ground handling services were reasonable at commercial airports. Specifically, the Assistant Deputy Under Secretary of Defense (Material and Distribution Management) had requested that we determine whether cost-effective commercial alternatives existed for into-plane contracting and whether fixed-base

operators with into-plane contracts were increasing prices charged for ground handling services to compensate for the lower fuel prices negotiated in into-plane contracts. We also reviewed the management control program as it related to the audit objective.
DTIC
Aircraft Fuels; Airports; Ground Handling; Procurement; Management Planning

12
ENGINEERING

Includes engineering (general); communications and radar; electronics and electrical engineering; fluid mechanics and heat transfer; instrumentation and photography; lasers and masers; mechanical engineering; quality assurance and reliability; and structural mechanics.

19990114244 Federal Aviation Administration, Fire Safety Section, Atlantic City, NJ USA
Simulating the Distribution of Halon 1301 in an Aircraft Engine Nacelle with HFC-125
Ingerson, D. A.; Aug. 1999; 38p; In English
Report No.(s): PB99-176950; DOT/FAA/AR-TN99/64; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

The primary fire suppressant used in commercial aircraft engine nacelles and auxiliary power units is Halon 1301. The period of fire suppression system development and its certification testing may be an arduous task requiring the discharge of substantial quantities of fire suppressant. Additionally, to demonstrate compliance with federal regulation, engine nacelle fire suppression systems are discharged in flight or at varying conditions simulating flight. Based on the Montreal Protocol and its amendments, the halon family of fire suppressants has been eliminated from production. This action is in response to the destructive capacity of halon with respect to the ozone layer within the atmosphere. This technical note describes a procedure for utilizing an ozone-friendly simulant during fire suppression system development and certification testing. It demonstrates a realistic potential to eliminate the release of Halon 1301 for purposes other than actual fire suppression.
NTIS
Aircraft Engines; Nacelles; Computerized Simulation

19990115491 National Defence Research Establishment, Div. of Sensor Technology, Linkoeping, Sweden
Semi-empirical Modeling of Apertures
Martin, T.; Smitting, T.; Baeckstroem, M.; Jul. 1998; 34p; In English
Contract(s)/Grant(s): NFFP Proj. 299
Report No.(s): PB99-174856; FOA-R-98-00834-612-SE; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The National Aeronautical Research Program (NFFP) - project 299, also called EMCB ('EMC - beraekningar'), is a project concerning computational electromagnetics with project participants from FOA, Ericsson Saab Avionics (ESB) and the Royal Institute of Technology (KTH). The aim of the project is to survey existing methods and if possible, improve methods for electromagnetic simulations concerning electromagnetic compatibility (EMC) or electromagnetic interference (EMI) in aircraft applications. The emphasis has been put on 'internal response', i.e. the electromagnetic field penetration into the aircraft interior. This report describes a method of how to include models of complex apertures into the Finite-Difference Time-Domain (FDTD) method without any knowledge about the geometrical details of the apertures. The electromagnetic properties of the apertures are measured in the terms of aperature transmission cross section. The aperture models are then based on the corresponding aperture polarizability which can be derived from the transmission cross section. Three different models have been implemented in FDTD. In the first two models the aperture is treated as an equivalent magnetic dipole.
NTIS
Aeronautical Engineering; Apertures; Computational Electromagnetics; Finite Difference Time Domain Method; Electromagnetic Scattering

19990116200 New Hampshire Univ., Durham, NH USA
Improving Pilot/ATC Voice Communication in General Aviation *Final Report*
Morrow, Daniel G.; Prinzo, O. V.; Jul. 1999; 27p; In English
Contract(s)/Grant(s): DTFA-02-96-P-54069
Report No.(s): AD-A367894; DOT/FAA/AM-99/21; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

The influence of Air Traffic Control (ATC) instruction format (grouped vs. sequential presentation) and message length on General Aviation pilot communication was investigated in a simulated flight environment using the Civil Aeromedical Institute's (CAMI's) Basic General Aviation Research Simulator (BGARS). Prior to flying the simulator each pilot was provided with

familiarization training, listened to and read back ATC messages spoken in either grouped or sequential format (depending on their assigned treatment group), and completed a digit span test (a measure of short-term memory). While flying 2 missions in the simulator, 12 pilots heard recorded ATC messages that contained altitude and radio frequency information spoken in a grouped format (e.g., "descend and maintain forty-one hundred"), and 12 heard the same instructions spoken sequentially (e.g., "descend and maintain four thousand one hundred"). The amount of information in a message varied from 2 to 5 speech acts, including the aircraft identification. All pilots were instructed to read back and execute the ATC instructions. Readback errors and requests to clarify ATC messages were the primary measures of pilot communication. Readback strategies, such as whether pilots repeated instructions in the same format as issued by ATC, were also examined. We found only limited evidence that the grouped format improved pilot memory for ATC messages. In one analysis of requests for clarification, pilots who received grouped instructions produced fewer requests than did pilots who received the same instructions in sequential format, suggesting that they were less likely to misunderstand the ATC messages. Pilots who received grouped instructions were also more likely to read back the grouped instructions in sequential format, suggesting that prior experience with the sequential format influenced pilot communication in this study.

DTIC

Air Traffic Control; Voice Communication; General Aviation Aircraft; Aircraft Communication

19990116084 Air Force Research Lab., Materials and Manufacturing Directorate, Tyndall AFB, FL USA

Requirements Document for Evaluation of Environmentally Preferable Aircraft Electrical Connectors *Final Report*

Nagny, Tom, Air Force Research Lab., USA; Slenski, George, Air Force Research Lab., USA; Keenan, Robert, Air Force Research Lab., USA; Chiles, Gary, Air Force Research Lab., USA; Nov. 25, 1998; 36p; In English

Contract(s)/Grant(s): F33615-95-D-5615

Report No.(s): AD-A366832; AFRL-ML-TY-TR-1999-4529; SAIC-01-0824-08-5227; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

This document describes the minimum requirements and desirable characteristics for an environmentally preferable electrical connector for use on U.S. Air Force aircraft. This report also describes a proposed test procedure that can be used to evaluate candidate connectors. Environmentally-preferable connectors should be made from materials less hazardous than those used in existing connectors, but that still possess adequate grounding and corrosion resistance. The hazardous materials of concern are the EPA-17 chemicals, including cadmium, chromium, and nickel, currently used in the manufacture of MIL-38999J Series I and II, finish B, and Series III and IV, Classes J and W, connectors. This document is divided into the following sections: 1. Section 1, Background, provides background information that defines the nature of the problem. 2. Section 2, Requirements, establishes the general requirements for an environmentally preferable connector. 3. Section 3, Test Layout, describes the order of the tests conducted on each connector. 4. Section 4, Rationale for Requirements and Characteristics, provides the rationale for the requirements that have been established in this document. 5. Section 5, Protocols, describes the procedures that will be used to evaluate candidate connectors. This document can be used as a basis for a formal test procedure.

DTIC

Electric Connectors; Protective Coatings; Corrosion Resistance; Aircraft Equipment

19990061887 California Univ., Mechanical and Aerospace Engineering Dept., Los Angeles, CA USA

A Numerical Study of Low-Reynolds-Number Separation Bubbles

Tatineni, Mahidhar, California Univ., USA; Zhong, Xiao-Lin, California Univ., USA; 1999; In English; 37th, Aerospace Sciences, 11-14 Jan. 1999, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): NCC2-374; NASA Order H-2354

Report No.(s): AIAA Paper 99-0523; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The present study uses two dimensional numerical simulations to study unsteady low-Reynolds-number separation bubbles. The numerical study is in two parts: (1) a two dimensional time-accurate Navier-Stokes solver is used to simulate flows over the APEX airfoil, and (2) a numerical procedure is developed for localized simulations of transitional separation bubbles. The 2-D computations of flow over the APEX airfoil show that the flow is unsteady with periodic vortex shedding. A linear stability analysis of the separated flow shows that the vortex shedding is caused due to the instability of the separated flow. For transonic flows over the APEX airfoil the vortex shedding is additionally influenced by the presence of shocks. The flowfield has two characteristic time scales, one corresponding to the vortex shedding and another corresponding to the movement of the shocks. The two dimensional (2-D) airfoil simulations also showed the presence of nonlinear effects in the separated region. to better understand the characteristics of separation bubbles a numerical procedure has been developed for localized separation bubble calculations. This procedure is used to perform computations for a flat plate separation bubble test case. The separation bubble

is induced by specifying a velocity gradient in the freestream. The growth of disturbances in the separation bubble is analyzed by introducing disturbances upstream of the separation bubble.
Author
Airfoils; Low Reynolds Number; Navier-Stokes Equation; Transonic Flow; Computational Fluid Dynamics; Vortex Shedding; Bubbles; Turbulent Flow; Two Dimensional Models; Boundary Layer Stability; Angle of Attack

19990061895 North Carolina State Univ., Raleigh, NC USA
Control of Cavity Resonance Using Steady and Oscillatory Blowing
Lamp, Alison M., North Carolina State Univ., USA; Cholcani, Ndaona, North Carolina State Univ., USA; April 1999; 35p; In English
Contract(s)/Grant(s): NAG1-1829; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An experimental study to investigate the effect of steady and oscillatory (with zero net mass flux) blowing on cavity resonance is undertaken. The objective is to study the basic mechanisms of the control of cavity resonance. An actuator is designed and calibrated to generate either steady blowing or oscillatory blowing with A zero net mass flux. The results of the experiment show that both steady and oscillatory blowing are effective, and reduce the amplitude of the dominant resonant mode by 10dB. The oscillatory blowing is however found to be more superior in that the same effectiveness could be accomplished with a momentum coefficient an order of magnitude smaller than for steady blowing. The experiment also confirms the results of previous computations that suggest the forcing frequency for oscillatory blowing must not be at harmonic frequencies of the cavity resonant modes.
Author
Steady Flow; Blowing; Noise Reduction; Jet Aircraft Noise; Airframes; Cavity Flow; Wind Tunnel Tests; Oscillating Flow

19990111482 Tuskegee Inst., Mechanical Engineering Dept., AL USA
Characterization of Flow Behind the Fan of a Turbofan Engine
Stee, Dave, Tuskegee Inst., USA; HBCUs/OMUs Research Conference Agenda and Abstracts; August 1999, pp. 36; In English; See also 19990111455; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The research grant was awarded to perform analysis of experimental data obtained from hot-wire measurements behind the fan of turbofan engine models. The experiments of were conducted at NASA Glenn Research Center. FORTRAN codes have been developed to analyze the data for flow characterization. Results obtained from the data analysis include estimates of mean and turbulent velocities, correlation and spectral functions, and turbulence scales at various locations downstream of the fan. Codes have also been developed to obtain wave number-frequency spectra from two-point measurement data from which estimates of integral scales as a function of frequency can be obtained. The codes have been tested against some known results and they are found to be satisfactory. The results obtained from the data analysis codes will be helpful for determining the turbulence characteristics of the flow and for understanding how the fan wake flow contributes to the broad band noise produced by the engines. The results might also give insights into how the fan blades and/or stator vanes can be redesigned to reduce engine noise. Furthermore, the results obtained from data analysis of the experimental data can provide valuable input to validate the computer codes developed to predict the flow field and hence the noise produced by the engine models.
Author
Flow Distribution; Noise Reduction; Turbofan Engines; Turbulence; Turbofans

19990114847 Alabama Univ., Huntsville, AL USA
Mixing of Supersonic Streams
Hawk, C. W., Alabama Univ., USA; Landrum, D. B., Alabama Univ., USA; Muller, S., Alabama Univ., USA; Turner, M., Alabama Univ., USA; Parkinson, D., Alabama Univ., USA; JANNAF Airbreathing Propulsion Subcommittee and 35th Combustion Subcommittee Meeting; December 1998; Volume 1, pp. 1-8; In English; See also 19990114846
Contract(s)/Grant(s): NCC8-123; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC, Hardcopy

The Strutjet approach to Rocket Based Combined Cycle (RBCC) propulsion depends upon fuel-rich flows from the rocket nozzles and turbine exhaust products mixing with the ingested air for successful operation in the ramjet and scramjet modes. It is desirable to delay this mixing process in the air-augmented mode of operation present during low speed flight. A model of the Strutjet device has been built and is undergoing test to investigate the mixing of the streams as a function of distance from the Strutjet exit plane during simulated low speed flight conditions. Cold flow testing of a 1/6 scale Strutjet model is underway and nearing completion. Planar Laser Induced Fluorescence (PLIF) diagnostic methods are being employed to observe the mixing of the turbine exhaust gas with the gases from both the primary rockets and the ingested air simulating low speed, air augmented

operation of the RBCC. The ratio of the pressure in the turbine exhaust duct to that in the rocket nozzle wall at the point of their intersection is the independent variable in these experiments. Tests were accomplished at values of 1.0, 1.5 and 2.0 for this parameter. Qualitative results illustrate the development of the mixing zone from the exit plane of the model to a distance of about 19 equivalent rocket nozzle exit diameters downstream. These data show the mixing to be confined in the vertical plane for all cases. The lateral expansion is more pronounced at a pressure ratio of 1.0 and suggests that mixing with the ingested flow would be likely beginning at a distance of 7 nozzle exit diameters downstream of the nozzle exit plane.

Author

Combustion Products; Confinement; Nozzle Walls; Pressure Ratio; Ramjet Engines; Rocket Nozzles; Supersonic Combustion Ramjet Engines

19990115861 NASA Lewis Research Center, Cleveland, OH USA

Computation of Three-Dimensional Compressible Flow From a Rectangular Nozzle with Delta Tabs

Reddy, D. R., NASA Lewis Research Center, USA; Steffen, C. J., Jr., NASA Lewis Research Center, USA; Zaman, K. B. M. Q., NASA Lewis Research Center, USA; Journal of Engineering for Gas Turbines and Power; April 1999; Volume 121, pp. 235-242; In English; International Gas Turbine and Aeroengine Congress and Exhibition, 2-5 Jun. 1997, Orlando, FL, USA

Report No.(s): Paper-97-GT-257; Copyright; Avail: Issuing Activity, Hardcopy

A three-dimensional viscous flow analysis is performed using a time-marching Reynolds-averaged Navier-Stokes code for a 3:1 rectangular nozzle with two delta tabs located at the nozzle exit plane to enhance mixing. Two flow configurations, a subsonic jet case and a supersonic jet case using the same rate configuration, which were previously studied experimentally, are computed and compared with the experimental data. The experimental data include streamwise velocity and vorticity distributions for the subsonic case, and Mach number distributions for the supersonic case, at various axial locations downstream of the nozzle exit. The computational results show very good agreement with the experimental data. In addition, the effect of compressibility on vorticity dynamics is examined by comparing the vorticity contours of the subsonic jet case with those of the supersonic jet case which were not measured in the experiment.

Author

Navier-Stokes Equation; Subsonic Flow; Supersonic Jet Flow; Tabs (Control Surfaces); Three Dimensional Flow; Vorticity; Exhaust Nozzles; Compressible Flow; Computational Fluid Dynamics; Noise Reduction; Aerodynamic Noise

19990115864 NASA Glenn Research Center, Cleveland, OH USA

Mixing of Multiple Jets with a Confined Subsonic Crossflow, Part 2, Opposed Rows of Orifices in Rectangular Ducts

Holdeman, J. D., NASA Glenn Research Center, USA; Liscinsky, D. S., United Technologies Corp., USA; Bain, D. B., CFD Research Corp., USA; Journal of Engineering for Gas Turbines and Power; July 1999; Volume 121, pp. 551-562; In English; International Gas Turbine and Aeroengine Congress and Exhibition, 2-5 Jun. 1997, Orland, FL, USA; Copyright; Avail: Issuing Activity, Hardcopy

This paper summarizes experimental and computational results on the mixing of opposed rows of jets with a confined subsonic crossflow in rectangular ducts. The studies from which these results were excerpted investigated flow and geometric variations typical of the complex three-dimensional flowfield in the combustion chambers in gas turbine engines. The principal observation was that the momentum-flux ratio, J, and the orifice spacing, S/H, were the most significant flow and geometric variables. Jet penetration was critical, and penetration decreased as either momentum-flux ratio or orifice spacing decreased. It also appeared that jet penetration remained similar with variations in orifice size, shape, spacing, and momentum-flux ratio when the orifice spacing was inversely proportional to the square-root of the momentum-flux ratio. It was also seen that planar averages must be considered in context with the distributions. Note also that the mass-flow ratios and the orifices investigated were often very large (jet-to-mainstream mass-flow ratio is greater than 1 and the ratio of orifices-area-to-mainstream- cross-sectional-area up to 0.5, respectively), and the axial planes of interest were often just downstream of the orifice trailing edge. Three-dimensional flow was a key part of efficient mixing and was observed for all configurations.

Author

Ducts; Gas Turbine Engines; Orifices; Three Dimensional Flow; Cross Flow; Duct Geometry; Annular Ducts; Combustion Chambers

19990116700 NASA Lewis Research Center, Cleveland, OH USA

Aerodynamic Analysis of Multistage Turbomachinery Flows in Support of Aerodynamic Design

Adamczyk, John J., NASA Lewis Research Center, USA; 1999; 40p; In English; Turbo Expo, 7-10 Jun. 1999, Indianapolis, IN, USA; Sponsored by American Society of Mechanical Engineers, USA

Contract(s)/Grant(s): RTOP 523-26-33; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper summarizes the state of 3D CFD based models of the time average flow field within axial flow multistage turbomachines. Emphasis is placed on models which are compatible with the industrial design environment and those models which offer the potential of providing credible results at both design and off-design operating conditions. The need to develop models which are free of aerodynamic input from semi-empirical design systems is stressed. The accuracy of such models is shown to be dependent upon their ability to account for the unsteady flow environment in multistage turbomachinery. The relevant flow physics associated with some of the unsteady flow processes present in axial flow multistage machinery are presented along with procedures which can be used to account for them in 3D CFD simulations. Sample results are presented for both axial flow compressors and axial flow turbines which help to illustrate the enhanced predictive capabilities afforded by including these procedures in 3D CFD simulations. Finally, suggestions are given for future work on the development of time average flow models.

Author

Aerodynamics; Axial Flow; Computational Fluid Dynamics; Design Analysis; Flow Distribution; Mathematical Models; Three Dimensional Models; Turbomachinery; Unsteady Flow; Navier-Stokes Equation

19990116904 NASA Glenn Research Center, Cleveland, OH USA

Multiphysics Simulation of Active Hypersonic Lip Cooling

Melis, Matthew E., NASA Glenn Research Center, USA; Wang, Wen-Ping, Centric Engineering Systems, Inc., USA; October 1999; 16p; In English; 1999 Norfolk Summer Conference, 28 Jun. - 1 Jul. 1999, Norfolk, VA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): NAS3-98068; RTOP 523-61-13

Report No.(s): NASA/TM-1999-209275; E-11731; AIAA Paper 99-3510; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This article describes the application of the Multidisciplinary Analysis (MDA) solver, Spectrum, in analyzing a hydrogen-cooled hypersonic cowl leading-edge structure. Spectrum, a multiphysics simulation code based on the finite element method, addresses compressible and incompressible fluid flow, structural, and thermal modeling, as well as the interactions between these disciplines. Fluid-solid-thermal interactions in a hydrogen impingement-cooled leading edge are predicted using Spectrum. Two- and semi-three-dimensional models are considered for a leading edge impingement coolant concept under either specified external heat flux or aerothermodynamic heating from a Mach 5 external flow interaction. The solution accuracy is demonstrated from mesh refinement analysis. With active cooling, the leading edge surface temperature is drastically reduced from 1807 K of the adiabatic condition to 418 K. The internal coolant temperature profile exhibits a sharp gradient near channel/solid interface. Results from two different cooling channel configurations are also presented to illustrate the different behavior of alternative active cooling schemes.

Author

Hypersonic Speed; Computerized Simulation; Computational Fluid Dynamics; Temperature Profiles; Aerothermodynamics; Surface Temperature

19990117005 West Virginia Univ., Morgantown, WV USA

Investigation of Point Doppler Velocimetry (PDV) for Transition Detection in Boundary Layers *Final Report*

Kuhlman, John M., West Virginia Univ., USA; November 1999; 107p; In English

Contract(s)/Grant(s): NAG1-1892; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

A two component Point Doppler Velocimetry (PDV) system has been developed and tested. Improvements were made to an earlier PDV system, in terms of experimental techniques, as well as the data acquisition and reduction software. Measurements of the streamwise and spanwise mean and fluctuating velocities for flows from a rectangular channel and over an NACA 0012 airfoil were made, and the data were compared against hot wire data. The closest to the airfoil surface that PDV measurements could be made was on the order of 0.005 m(0.2", z/c = 0.0169). When the PDV and hot wire data were compared, the time traces for each appeared similar. The mean velocities agreed to within plus or minus 2 m/sec, while the RMS velocities agreed to plus or minus 0.4 m/sec. While the PDV time autocorrelations agreed with those of the hot wire data, the PDV power spectral densities were noisier above 750 Hz. A major source of error in these experiments was determined to be the drifting of the iodine cell stem temperatures. While the stem temperatures were controlled to within plus or minus 0.1 C, this could lead to a frequency shift of as much as 6 MHz, which translates into an error of 1.6 m/sec for the back scatter channel, and up to 6.9 m/sec for the forward scatter channel. These error estimates are consistent with the observed error magnitudes.

Author

Velocity Measurement; Computational Fluid Dynamics; Boundary Layers; Airfoils

19990110318 Boeing Co., Rocketdyne Propulsion and Power, Canoga Park, CA USA

Rotor Re-Design for the SSME Fuel Flowmeter

Marcu, Bogdan, Boeing Co., USA; [1999]; 34p; In English; Thermal and Fluids Analysis Workshop, 13-17 Sep. 1999, Huntsville, AL, USA; Original contains color illustrations

Contract(s)/Grant(s): NAS8-45000; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The present report describes the process of redesigning a new rotor for the SSME Fuel Flowmeter. The new design addresses the specific requirement of a lower rotor speed which would allow the SSME operation at 1 15% rated power level without reaching a blade excitation by the wakes behind the hexagonal flow straightener upstream at frequencies close to the blade natural frequency. A series of calculations combining fleet flowmeters test data, airfoil fluid dynamics and CFD simulations of flow patterns behind the flowmeter's hexagonal straightener has led to a blade twist design alpha = alpha (radius) targeting a kf constant of 0.8256. The kf constant relates the fuel volume flow to the flowmeter rotor speed, for this particular value 17685 GPM at 3650 RPM. Based on this angle distribution, two actual blade designs were developed. A first design using the same blade airfoil as the original design targeted the new kf value only. A second design using a variable blade chord length and airfoil relative thickness targeted simultaneously the new kf value and an optimum blade design destined to provide smooth and stable operation and a significant increase in the blade natural frequency associated with the first bending mode, such that a comfortable margin could be obtained at 115% RPL. The second design is a result of a concurrent engineering process, during which several iterations were made in order to achieve a targeted blade natural frequency associated with the first bending mode of 1300 Hz. Water flow tests preliminary results indicate a kf value of 0.8179 for the f-irst design, which is within 1% of the target value. The second design rotor shows a natural frequency associated with the first bending mode of 1308 Hz, and a water-flow calibration constant of kf 0.8169.

Author

Design Analysis; Rotors; Flowmeters; Computational Fluid Dynamics; Flow Distribution; Fluid Dynamics; Rotor Speed

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GEOSCIENCES

Includes geosciences (general); earth resources and remote sensing; energy production and conversion; environment pollution; geophysics; meteorology and climatology; and oceanography.

19990107395 NASA Marshall Space Flight Center, Huntsville, AL USA

Nitrogen Oxides and Ozone from B-747 Measurements (NOXAR) During POLINAT-2 and SONEX: Overview and Case Studies on Continental and Marine Convection

Jeker, Dominique P., Institute for Atmospheric Science, Switzerland; Pfister, Lenny, NASA Ames Research Center, USA; Brunner, Dominik, Royal Netherlands Meteorological Inst., Netherlands; Boccippio, Dennis J., NASA Marshall Space Flight Center, USA; Pickering, Kenneth E., Maryland Univ., USA; Thompson, Anne M., NASA Goddard Space Flight Center, USA; Wernli, Heini, Institute for Atmospheric Science, Switzerland; Selkirk, Rennie B., NASA Ames Research Center, USA; Kondo, Yutaka, Nagoya Univ., Japan; Koike, Matoke, Nagoya Univ., Japan; [1997]; 2p; In English; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

In the framework of the project POLINAT 2 (Pollution in the North Atlantic Flight Corridor) we measured NO(x) (NO and NO2) and ozone on 85 flights through the North Atlantic Flight Corridor (NAFC) with a fully automated system permanently installed aboard an in-service Swissair B-747 airliner in the period of August to November 1997. The averaged NO(x) concentrations both in the NAFC and at the U.S. east coast were similar to that measured in autumn 1995 with the same system. The patchy occurrence of NO(x) enhancements up to 3000 pptv over several hundred kilometers (plumes), predominately found over the U.S. east coast lead to a log-normal NO(x) probability density function. In three case studies we examine the origins of such plumes by combining back-trajectories with brightness temperature enhanced (IR) satellite imagery, lightning observations from the U.S. National Lightning Detection Network (NLDN) and the Optical Transient Detector (OTD) satellite. We demonstrate that the location of NO(x) plumes can be well explained with maps of convective influence. We show that the number of lightning flashes in cluster of marine thunderstorms is proportional to the NO(x) concentrations observed several hundred kilometers downwind of the anvil outflows. From the fact that in autumn the NO(x) maximum was found several hundred kilometers off the U.S. east coast, it can be inferred that thunderstorms triggered over the warm Gulf Stream current are major sources for the regional upper tropospheric NO(x) budget in autumn.

Author

Boeing 747 Aircraft; Transport Aircraft; Jet Exhaust; Exhaust Gases; Nitrogen Oxides; Ozone; Plumes

19990108685 NASA Kennedy Space Center, Cocoa Beach, FL USA

Lightning Launch Commit Criteria for America's Space Program

Roeder, W. P., Weather Squadron (45th), USA; Sardonia, J. E., Weather Squadron (45th), USA; Jacobs, S. C., Weather Squadron (45th), USA; Hinson, M. S., Weather Squadron (45th), USA; Harms, D. E., Weather Squadron (45th), USA; Madura, J. T., NASA Kennedy Space Center, USA; DeSordi, S. P., Weather Squadron (30th), USA; 11th International Conference on Atmospheric Electricity; June 1999, pp. 238-241; In English; See also 19990108601; No Copyright; Avail: CASI; A01, Hardcopy; A10, Microfiche

The danger of natural and triggered lightning significantly impacts space launch operations supported by the USAF. The lightning Launch Commit Criteria (LCC) are used by the USAF to avoid these lightning threats to space launches. This paper presents a brief overview of the LCC.

Author

Lightning; Spacecraft Launching; Criteria; Flight Hazards

19990108688 Federal Aviation Administration, Washington, DC USA

Preliminary FAA Investigations Into Using Total Lightning to Improve Convective Forecasting for Aviation

Nietow, A., Federal Aviation Administration, USA; Showalter, R. C., CTA, Inc., USA; Souders, C. G., Science Applications International Corp., USA; 11th International Conference on Atmospheric Electricity; June 1999, pp. 246-249; In English; See also 19990108601; No Copyright; Avail: CASI; A01, Hardcopy; A10, Microfiche

The Federal Aviation Administration (FAA) is investigating the use of total lightning (Cloud-to-Ground (CG), Intra-Cloud (IC), and Cloud-to-Cloud (CC) strokes) to supplement existing weather data sets in order to meet current requirements for convective forecasting, enhance aviation safety, and increase capacity. Total lightning could significantly enhance the ability to provide information on rapidly developing hazardous weather to both en route and terminal air traffic control personnel. The FAA is also evaluating the use of lightning data over oceanic regions.

Author

Lightning; Detection; Aircraft Safety; Weather Forecasting; Computer Networks

19990114870 Texas A&M Univ., Texas Transportation Inst., College Station, TX USA

Delivering Weather Data to Texas Pilots and Other Users *Topical Report, Sep. 1997 - Aug. 1998*

Noel, J. S.; Copeland, L. A.; Staas, D.; Dresser, G. B.; Feb. 1999; 152p; In English

Report No.(s): PB99-158248; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

This project will ultimately serve to supplement the manner in which Texas pilots receive weather data. This will be accomplished first by inventorying the sources used by pilots to get weather data. The reliability, and convenience, of these sources will be evaluated and the unmet needs enumerated. The approach described above will be tailored to the needs of pilots with all levels of competency. Characterizing these sources of weather data and contrasting them to the classes and needs of Texas pilots is the essence of the first year of the project.

NTIS

Texas; Aircraft Pilots; Remote Sensing; Meteorological Parameters

14
LIFE SCIENCES

Includes life sciences (general); aerospace medicine; behavioral sciences; man/system technology and life support; and space biology.

19990109233 Institute of Space Medico, Space Medicine and Medical Engineering, Beijing, China

Effect of wind tunnel noise on left ventricular function of heart

Tiancheng, Zhang, Institute of Space Medico, China; Ju, Liu, Institute of Space Medico, China; Space Medicine and Medical Engineering; Jun. 1997; Volume 10, No. 3, pp. 217-219; In English; In Chinese; See also 19990109220; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

A two-dimensional color doppler ultrasonic imaging instrument was used to detect the left ventricular function in 36 wind tunnel technicians before and after their work in the wind tunnel. The results showed that under the noise between 91.5 and 101.5 dB(A) inside the wind tunnel SV, EF, Fs, MVCF, PE, SE and EAC decreased while SA, PA/PE increased. It indicates that high level wind tunnel noise has certain harmful effect on the left ventricular function of wind tunnel technicians.

Author

Aerodynamic Noise; Heart; Wind Effects; Wind Tunnels; Physiological Effects

19990114981 Air Force Research Lab., Human Effectiveness Directorate, Wright-Patterson AFB, OH USA

A Pilot Study of Occupational Assessment of Air Force Personnel Exposure to Jet Fuel Before and After Conversion to JP-8 *Interim Report, 1 Jun. 1995-1 Apr. 1998*

Olsen, Donna M.; Mattie, David R.; Gould, William D.; Witzmann, Frank; Ledbetter, Mark; Sep. 1998; 53p; In English

Contract(s)/Grant(s): Proj-7757

Report No.(s): AD-A367582; AFRL-HE-WP-TR-1998-0107; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The purpose of this study was to compare workers' health while JP-4 was still in use and after conversion to JP-8. Measures of effect were blood tests for liver, kidney and hematopoietic system function and serum protein analysis, neurocognitive function, and general health (history and physical exam). A cohort of 18 exposed and 18 non-exposed subjects, matched for gender and age, were measured 4 times over a period of 18 months while JP-4 was used, and at 3, 6 and 18 months after conversion to JP-8. Air sampling showed levels of naphthas during JP-8 use comparable to JP-4. Benzene, non-detectable in JP-8, compared to 0.05 ppm in JP-4. No significant differences were found between exposed and non-exposed subjects in liver and kidney function, neurocognitive function, frequency of symptoms, or general health. A rash on the hands was observed in 2 subjects using JP-8. No changes were seen in any of the complete blood count parameters between JP-4 and JP-8 use. Mean Corpuscular Hemoglobin and Mean Corpuscular Volume were statistically significantly lower in the exposed subjects at all sampling periods, indicating it may be an effect of jet fuel exposure in general. Mean Corpuscular Hemoglobin Concentration was significantly higher after conversion to JP-8 in the exposed subjects. Further study of larger samples is needed.

DTIC

Exposure; Jet Engine Fuels; JP-4 Jet Fuel; JP-8 Jet Fuel

19990116619 Naval Air Warfare Center, Aircraft Div., Patuxent River, MD USA

The Effect of Aircrew Age on +Gz Tolerance as Measured in a Human-Use Centrifuge. (Abstracts)

Forster, Estrella; Shender, Barry; Apr. 23, 1999; 3p; In English

Report No.(s): AD-A368563; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

A data repository was established in 1988 to compile information on 1,120 aircrew (74% pilots) who underwent acceleration (+Gz) tolerance training at NAWOAD Patuxent River human-use centrifuge. 51% of the aircrew flew in high performance aircraft (F-4, F14, F15, F16, and F18). The trainees were U.S. Navy/Marine Corps (70%) and Air National Guard (30%) aircrew. Balanced data from 817 healthy male trainees were examined. Mean age (+S.D.) was 31.4 i 6.8 years (20 to 5g). Relaxed tolerance was 4.91 i 0.93 +Gz and was shown to be independent of age (R2 - 0.005). Straining tolerance was 7.17 + 1.27 +Gz. Age did not have an effect on straining +Gz tolerance (R2 = 0.017). The protection afforded by the AGSM was 2.72 j 0.84 +Gz and was not affected by trainee age (R2 = 0.007). Age did not demonstrate to have an effect on G-LOC incidence. Exposures where cardiovascular data was analyzed (n=1 9) ranges from 5 to 9 +Gz (5.5 i 1.3). The change described by MHR-RHR was 57 i 21 bpm. The change described by MHR-RCVHR was 62 * 27 bpm. Multiple regress demonstrated that age and the +Gz level at which the MHR occurred (GMHR) explained 55% of the variability in MHR-RCVHR (R2 age = 0.18, pT% = 0.01; R2 GMHR = 0.37, pT% = 0.002). The model was described by MHR-RCVHR = 19.03 - 1.40*age + 13.084GMHR (F= 9.87, p = 0.001). No statistically significant relationship was found based on change in MHR-RHR. The relative long duration GOR exposures are typically used to determine cardiovascular +Gz tolerance in human-use centrifuge studies. Based on the variables examined in this retrospective stud there does not seem to be a Significant effect on a e on +Gz tolerance.

DTIC

Students; Acceleration Tolerance; F-14 Aircraft; Armed Forces (USA)

19990117186 ManTech Environmental Technology, Inc., Dayton, OH USA

Dermal Absorption of JP-8 Jet Fuel and Its Components *Interim Report, May 1998 - Mar. 1999*

McDougal, James, ManTech Environmental Technology, Inc., USA; Pollard, Daniel L., ManTech Environmental Technology, Inc., USA; Garrett, Carol M., ManTech Environmental Technology, Inc., USA; Davis, Robert M., Armstrong Lab., USA; Miller, Tomas E., Armstrong Lab., USA; Mar. 1999; 27p; In English

Contract(s)/Grant(s): F41624-96-C-9010; AF Proj. 7757

Report No.(s): AD-A369228; AFRL-HE-WP-TR-1999-0021; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

The dermal absorption of jet fuels in general and JP-8 in particular is not well understood, even though the use by government and industry, worldwide, is over 59 billion gallons per year. JP-8, which is similar to kerosene, is composed of hundreds and perhaps thousands of hydrocarbon chemicals and their isomers. Exposures to JP-8 can occur from vapor, liquid or aerosol. Inhalation and dermal are the most prevalent routes of exposure. It is recognized that JP-8 may cause irritation when the skin is exposed repeatedly or for prolonged periods, but whether systemic toxicity from dermal absorption of fuels may occur is unknown. The purpose of this investigation was to measure the flux of JP-8 and its major constituents through rodent skin to assess

the potential for systemic effects with human exposures. The composition of a specific test sample (POSF-3509) of JP-8 was analyzed. Static diffusion cells containing dermatomed rodent skin were used to determine the flux of JP-8 and it's components. Thirteen individual components of JP-8 were identified in the receptor solution. The flux from this JP-8 fuel ranged from a high of 82.4 nanograms/cm2/hr (the additive DIEGME) to a low of 0.5 nanograms/cm2/hr (tridecane). Permeability coefficients, which can be used to estimate the absorption of components from other fuels, were also calculated. These fluxes suggest that JP-8 will not cause systemic toxicity.
DTIC
Permeability; Jet Engine Fuels; Aerosols

19990117204 ManTech Environmental Technology, Inc., Dayton, OH USA
Repeated Dose Skin Irritation Study on Jet Fuels: A Histopathology Study *Final Report, 1 Jun. 1998 - 1 Jun. 1999*
Baker, William, ManTech Environmental Technology, Inc., USA; Miller, Thomas, ManTech Environmental Technology, Inc., USA; Dodd, Darol, ManTech Environmental Technology, Inc., USA; McDougal, James, ManTech Environmental Technology, Inc., USA; Mar. 1999; 31p; In English
Contract(s)/Grant(s): F41624-96-C-9010; AF Proj. 7757
Report No.(s): AD-A369302; AFRL-HE-WP-TR-1999-0022; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

JP-8 is the battlefield fuel for DoD and NATO countries. It's use is projected beyond 2025, with employment of additive packages to meet new weapon systems' requirements. One additive package (JP-8 + 100) currently in use increases the thermal stability of the fuel by 100 F. Questions have been raised about human health implications of occupational exposures to JP-8, as compared to the phased out JP-4, and to possible differences between JP-8 and JP-8 + 100. This study investigated the histopathologic effects of daily, topical, dermal exposure to JP-8 + 100, JP-4 and JP-8 in rats. Full thickness samples of control and treated skin were taken at weekly intervals during the 4-week exposure phase and the 3-week recovery phase. Proliferative, degenerative, and inflammatory changes within the epidermis and dermis were assessed and graded. Mean scores during the exposure phase (69.3 +/- 24.4, 58.9 +/- 7.8, and 69.5 +/- 20.0 for JP-8 + 100, JP-4, and JP-8, respectively) were significantly different from mean control scores of 16.8 +/- 3.6 (P is less than 0.0001). Treatment group scores did not differ significantly from one another. Characteristic of all treatment groups was the rapid reversibility of the lesions following withdrawal from exposure. Mean scores during the recovery phase (29.1 +/- 4.2, 19.7 +/- 2.7, and 21.6 +/- 7.0 for JP-8 + 100, JP-4, and JP-8, respectively) did not differ from control scores.
DTIC
Skin (Anatomy); Irritation; Dosage; JP-4 Jet Fuel; JP-8 Jet Fuel; Aerospace Medicine

19990114889 Army Command and General Staff Coll., Fort Leavenworth, KS USA
USA Air Force Weapons School F-16 Division Revised Flying and Academic Syllabus Flow
Weggeman, Christopher P.; Jan. 1999; 82p; In English
Report No.(s): AD-A367888; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This study investigates the potential benefits associated with altering the flow in which the F-16 Division (WSF) of the USAF Weapons School executes their flying and academic syllabus. It analyzes the potential for increased instructional quality within the F-16 Division as a result of syllabus flow alterations. The F-16 Division of the USAF Weapons School currently executes two twelve-man student classes per calendar year. Their mission is to produce weapons instructors who possess the knowledge and skills necessary to provide weapons and weapons-related systems, and tactics expertise at the squadron, wing, and headquarters level. These graduates are highly trained in communications skills and effective instructional techniques both in the academic and flying environment. They are well versed in the structure and policies of the Combat Air Force and can interface with all elements to bring about effective combat ready forces. This study analyzes the current F-16 Division flying and academic syllabus flow for training and instructional shortfalls. It proposes a revised flying and academic syllabus flow designed to increase student learning, reduce student-based attrition, increase flying event continuity, and maximize student academic retention and application throughout its execution. These benefits are necessary given the comprehensive nature of the F-16 Division's mission, their finite training cycle allotment, and the ever-increasing repertoire of F-16 weapons systems and missions.
DTIC
Education; Schools; Jet Aircraft; Flight Training

19990114984 Army Command and General Staff Coll., Fort Leavenworth, KS USA
Air Force F-16 Joint Suppression of Enemy Air Defenses Training: A Model for Operational Failure
Norman, Jon A.; Jun. 04, 1999; 131p; In English
Report No.(s): AD-A367687; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This thesis investigates the question: How should the U.S. Air Force (USAF) modify F-16 Suppression of Enemy Air Defenses (SEAD) training to ensure pilots have the operational flying experience and proficiency required to conduct effective Joint Suppression of Enemy Air Defenses (J-SEAD) operations in combat? USAF F-16 SEAD pilots are not receiving the quantity and quality of training required to conduct effective J-SEAD operations in combat. USAF F-16 SEAD pilots must be trained for J-SEAD to prevent operational failure in combat. The thesis analyzes and evaluates joint training requirements, programs, and combat employment cases to identify USAF J-SEAD training shortfalls. The current and planned trend for joint training is to replace high-cost, live training exercises with simulation-based exercises to reduce costs. This trend has significantly impacted operational readiness and has prevented effective J-SEAD training for USAF F-16 SEAD pilots. J-SEAD must be identified as a mission essential task for the USAF. Pilots cannot afford to wait until combat to develop effective J-SEAD joint tactics, techniques, and procedures. Simulation training should be used to enhance flying training not replace it. The addition of J-SEAD objectives and forces to exercises can be accomplished by simply training smarter.
DTIC
F-16 Aircraft; Air Defense; Pilot Training; Flight Operations; Maintainability

19990116831 Naval Air Warfare Center, Aircraft Div., Patuxent River, MD USA
Effects of Physiologic Heat Stress on Cognitive Performance During Simulated Flight Tasks
Shender, Barry; Askew, Gregory; Kaufman, Jonathan; Shaaf, Linda; Mar. 25, 1999; 2p; In English
Report No.(s): AD-A368622; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

It is known that heat stress leads to reduced +Gz-tolerance in tactical aircrew. The first phase of an effort to determine the relationship between physiologic heat stress and flight performance was conducted using the new NAWCADPAX flight simulator installed in an environmental chamber. Performance scores declined after subjects were exposed to the hot alert conditions relative to control, though the difference was not statistically significant. Correlation analysis indicated a marginal relationship between the change in performance and rectal and mean skin temperatures ($r = 0.59$ and 0.55, respectively). The experimental design did not account for the increased generation of metabolic heat associated with straining against high G forces, though it did include radiant heat loads. The next phase will include physical work in the cockpit to account for this additional factor.
DTIC
Cognition; Flight Simulators; High Acceleration; Flight Characteristics; High Temperature Environments

19990116907 Naval Air Warfare Center, Aircraft Div., Patuxent River, MD USA
Identification of the Cognitive, Psychomotor, and Psychosocial Skill Demands of Uninhabited Combat Aerial Vehicle (UCAV) Operators
Kay, G.; Dolgin, D.; Wasel, B.; Langelier, M.; Hoffman, C.; Jun. 21, 1999; 16p; In English
Report No.(s): AD-A368578; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Unmanned Combat Aerial Vehicles extend tactical the range of aircraft mission options. Although certain cultural barriers exist with regard to complete acceptance of remotely controlled aircraft, the UCAV will become an essential part of many Air Forces in the years to come. A critical factor to the success of UCAV missions is the optimal selection of operators. This paper explores options for improving the selection and training of UCAV operators and reviews test that may be useful toward an improved screening system. Emphasis is placed upon the assessment of decision-making ability, personality factors, and related cognitive attributes with recommendations for future research directions. In the interest of identifying a valid UCAV test battery that will reliably predict successful completion of both UCAV training and operational performance, program managers are encouraged to consider funding selection programs that evaluate psychological measures of individual differences, in addition to the standard psychomotor coordination measures.
DTIC
Remotely Piloted Vehicles; Mission Planning; Psychomotor Performance; Pilotless Aircraft

19990114891 Naval Air Warfare Center, Aircraft Div., Patuxent River, MD USA
Dynamic Strength Capabilities of Small Stature Females to Perform High Performance Flight Tasks
Shender, Barry; Heffner, Peggy; Jul. 08, 1999; 41p; In English
Report No.(s): AD-A367879; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

NAWOAD investigated the abilities of small stature females (=/<s less than 120 lb) to fly under G-stress using the Dynamic Flight Simulator (DFS) and its tactical fight/attack cockpit, displays and controls. The objective was to determine if these individuals possess sufficient muscular endurance to perform tasks required during fighter pilot training, aerial combat maneuvers, and failure modes. Five subjects (four small stature females and one medium female) participated. DFS tasks featured bombing runs, SAM avoidance, and single engine failure. Muscular exertion and fatigue (arm, shoulder, neck) were assessed using

EMG. Flight performance did not significantly degrade over time. Human factors deficiencies were noted in the areas of torso harness fit, inertia reel placement relative to shoulder width, and the ability to maintain a full range of stick motion. Within the scope of these tests, small stature females demonstrated the strength and endurance to safely fly physically strenuous missions. However, cockpit accommodation and pilot reach limits may hinder the small stature pilot during flight emergencies.
DTIC
Pilots; Flight Simulators; Endurance; Acceleration Tolerance; Pilot Training

19990114962 Naval Air Warfare Center, Aircraft Div., Patuxent River, MD USA
Capabilities of Small Stature Women to Perform Operational Flight Tasks During G-Stress
Shender, Barry; Jul. 06, 1999; 12p; In English
Report No.(s): AD-A367868; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

With expansion of the role of women in military combat operations, including those in the fifth percentile for weight, i.e., 120 (54.4 kg) pounds or less, it is essential to determine is such individuals can perform certain tasks under dynamic conditions given their small stature. In particular this study addresses whether these females possess the upper body muscular endurance to perform high performance flight maneuvers such as those experienced in training, air combat and during emergency flight conditions. The ability to eject and support added head weight, as required by the use of helmet mounted devices, is also determined. Muscular strength and endurance requirements for various critical tasks performed in USN fixed wing aircraft were assessed based on a survey of aircraft model managers conducted by the Naval Aerospace Medical Research Lab in 1994. A synopsis of their responses can be found in reference 12. Overall, the model managers indicated that for high performance aircraft, brute strength was not a major requirement. The most critical muscular strength issue was the need for sufficient muscular endurance, particularly during high-G maneuvers.
DTIC
Acceleration Tolerance; Muscular Strength; Military Operations; Aircraft Configurations

19990114966 Naval Air Warfare Center, Aircraft Div., Patuxent River, MD USA
Dynamic Strength Capabilities of Small Stature Females to Eject and Support Added Head Weight
Shender, Barry; Heffner, Peggy; Aug. 03, 1999; 37p; In English
Report No.(s): AD-A367876; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

NAWCAD investigated the abilities of small stature females (=/<s less than 120 lb) to fly under G-stress using the Dynamic Flight Simulator (DFS) and its tactical fight/attack cockpit, displays and controls. Determine ability to exert NACES ejection seat actuation pull force under static, acceleration and simulated flight conditions; support up to 5 lb of added head weight (AHW) under catapult, arrestment, and aerial combat maneuver G-loads; and reach all controls. Ten subjects (six small stature females, on medium female and three males) participated. The AHW task included three helmet weights, 3.5 lb (standard configuration), 4.25 lb and 5 lb and subjects were tasked to accurately read cockpit displays. Muscular exertion and fatigue (arm, shoulder, neck) assessment used EMG. Women successfully ejected using a two-hand grip under G-stress. Subjects read all displays supporting 5 lb under 4.6 Gz. Most small stature female subjects could not fully support their heads wearing 3.5 lb helmet during flat spin conditions. Human factors deficiencies were noted in the areas of torso harness fit, inertia reel placement relative to shoulder width, and the ability maintain a full range of stick motion. Within the scope of these tests, small stature females demonstrated the strength to safely initiate ejection during severe physically taxing dynamic conditions but had difficulty supporting AHW under -Gx stress. Cockpit accommodation and pilot reach limits may hinder the small stature pilot during flight emergencies.
DTIC
Ejection Seats; Acceleration Tolerance; Adaptation; Muscular Fatigue; Flight Conditions

19990114972 Naval Air Warfare Center, Aircraft Div., Patuxent River, MD USA
Human Physiological Responses to Push-Pull Acceleration as Experienced in Helicopters
Shender, Barry S.; Jul. 13, 1999; 82p; In English
Report No.(s): AD-A367755; NAWCADPAX--99-74-TR; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

NAWCAD Patuxent River assessed the risk to helicopter aircrew of acceleration stress by investigating the human physiologic response to transitions from -1 Gz (push) to +4.5 Gz (pull) loads. Nine volunteers participated in a human centrifuge study in which nine actual helicopter maneuvers were reproduced in a 1 hr mission scenario (push-pull mission (PPM)) which simulated both current (current mode (CM): -0.2 to +3.5 Gz) and future capabilities of U.S. Navy helicopters (future mode (FM): -1 to +4.5 Gz). Additional scenarios were run in which transitions is less than 1 Gz were fixed at +1 Gz. Blood pressure, loss of vision, and subjective fatigue were measured. Visual decrements were trivial during CM while muscular tensing was required to avoid blackout during FM. Subjects tolerated the range of Gz-stresses associated with current U.S. Navy platforms. When

subjected to FM PPM G-loads (typical of current U.S. Army platforms), cardiovascular stress significantly increased, Gz tolerance dropped up to 1.2 g, and heart rate increased as much as 67 bpm. Four subjects reported Almost-loss of Consciousness symptoms during FM. While G-stress experienced by aircrew generated by current helicopters does not appear to present a high risk, G awareness training is recommended to reduce risks to aircrew exposed to G-loads generated by more aggressive helicopters.
DTIC
Helicopters; Cardiovascular System; Blood Pressure; Stimulation; Fatigue (Biology)

19990116699 Naval Air Warfare Center, Aircraft Div., Patuxent River, MD USA
Capabilities of Small Stature Women to Perform Operational Flight Tasks During G-Stress. (Abstracts)
Shender, BArry; Mar. 25, 1999; 2p; In English
Report No.(s): AD-A368562; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

To accommodate the needs of women in participating in expanded combat roles, NAWCAD is investigating the dynamic strength capabilities of small stature females (54.4 kg (120 lb.) or less) to eject, support added head weight, and fly under G-stress. Within the scope of these tests, small stature females demonstrated the strength and endurance to safely fly physically strenuous missions and safely initiate ejection during severe physically taxing dynamic conditions. However, cockpit accommodation and pilot reach limits may hinder the small stature pilot during flight emergencies requiring full stick authority or ejection during flat spin and arrestment. Additionally, some small stature female pilots may not be able to properly position their heads due to a combination of inadequate restraint and lack of sufficient neck strength to read critical displays during flat spin recovery conditions and arrestment.
DTIC
Flight Simulation; Females; Muscular Strength

19990116796 Army Aeromedical Research Lab., Fort Rucker, AL USA
The Effect of Helmet Mounted Display Field-of-View Configurations on Target Acquisition *Final Report*
Klymenko, Victor; Harding, Thomas H.; Beasley, Howard H.; Martin, John S.; Sep. 1999; 35p; In English
Contract(s)/Grant(s): Proj-3O162787A879
Report No.(s): AD-A368601; USAARL-99-19; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Monocular helmet-mounted displays (HMDs) currently are used in the Army's AH-64 Apache helicopter. A partial binocular overlap HMD is slated for use with the Army's new RAH-66 Comanche helicopter. The size of the binocular HMD's field-of-view (FOV) is the size of the visual world available to the Army helicopter pilot via an imaging sensor. The Comanche HMD presents the FOV in a partial binocular overlap configuration rather than a full binocular overlap configuration. In this latter configuration, the images presented to both eyes, the monocular fields, present identical views of the visual world where the FOV consists of a single binocular region. In the partial binocular overlap configuration, the FOV consists of a central binocular overlap region seen by both eyes, and two flanking monocular regions, each seen by one eye. What is the operational effectiveness of this new visual interface? First, we briefly describe the relevant differences between normal unaided vision and vision with a binocular HMD. Then, we cover our recent empirical findings on the sensory and perceptual effects of this type of display and how visual performance might be affected. Any deficits in performance need to be quantified before they are manifested on the battlefield. This study investigates how target acquisition is affected by implementing various configurations of the HMD's binocular display.
DTIC
Target Acquisition; Helicopters; Configurations; Helmet Mounted Displays; Field of View

19990116966 Naval Air Warfare Center, Aircraft Div., Patuxent River, MD USA
Safety of Flight and Anthropometry in USA Navy Aircraft
Tucker, Heather D.; Crawford, Jennifer J.; Sep. 10, 1998; 9p; In English
Report No.(s): AD-A368526; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The U.S. Navy initiated a tri-service effort in 1994 to agree on a population data set representative of the future Department of Defense aviator pool, map current Naval aircraft crew stations, and standardize methods to evaluate crew member accommodation. The Joint Primary Aircraft Training System (JPATS) is specified to accommodate a much wider range of pilot body sizes than any other aircraft in USN/USAF history. Based on the jointly-selected JPATS population, the USN anticipated a concern for this expanded range of pilots to safely fly subsequent aircraft and a need to reengineer those aircraft to better meet a Congressional mandate for female accommodation.
DTIC
Flight Training; Anthropometry; Aircraft Pilots

15
MATHEMATICAL AND COMPUTER SCIENCES

Includes mathematical and computer sciences (general); computer operations and hardware; computer programming and software; computer systems; cybernetics; numerical analysis; statistics and probability; systems analysis; and theoretical mathematics.

19990061936 Georgia Inst. of Tech., Aerospace Systems Design Lab., Atlanta, GA USA

New Approaches to Multidisciplinary Design and Optimization

Schrage, D. P., Georgia Inst. of Tech., USA; Craig, J. I., Georgia Inst. of Tech., USA; Fulton, R. E., Georgia Inst. of Tech., USA; Mistree, F., Georgia Inst. of Tech., USA; Sep. 26, 1994; 5p; In English; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Georgia Tech has followed an open architecture approach to concurrent engineering whereby parallel product and process trades are used to supplement an explicit decision-making process. The multidisciplinary High Speed Civil Transport wing integration problem is being used as the GIT IPPD case study. The problem will entail structural and aeroelastic optimization, including Rockwell Active Flexible Wing Technology. Emerging Lockheed lean aircraft manufacturing and advanced structures and materials developments will be incorporated as the problem is refined. The overall objective of the GIT proposal is to provide a mechanism for building and evaluation virtual designs of advanced aerospace vehicles to be used by interdisciplinary design teams. The Interdisciplinary Design Engineering Simulator (IDES) will merge IPPD methodologies with interdisciplinary analysis techniques and state-of-the-art computational technologies.

Derived from text

Multidisciplinary Design Optimization; Aeroelasticity; Decision Making; Concurrent Engineering; Flexible Wings

19990116909 Naval Air Warfare Center, Aircraft Div., Patuxent River, MD USA

ACETEF in JADS-EW Tests - Generating Products and Learning Lessons

Zimmerman, Philomena; Jul. 22, 1999; 3p; In English

Report No.(s): AD-A368586; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Use of Modeling and Simulation (M&S) test facilities is becoming more commonplace. These facilities rely on tools, such as distributed simulation both internally to the facility and externally to link with other facilities, to increase their ability to provide a better environment to the system under test (SUT), provide the warfighter with a better end product, and the taxpayer with more testing for their dollar. Such is certainly the case with the Air Combat Test and Evaluation Facility (ACETEF) at NAWCAD Patuxent River, Maryland. Use of distributed simulation is native to ACETEF, as a tool to be employed in the test process. However, distributed simulation to JADS was not a tool to be used in a test, it was the SUT. All in all, the JADS experience for ACETEF was a positive one, and through the test needs and timeline, allowed ACETEF to broaden and, at the same time, refine its distributed simulation practices. to ACETEF personnel, it reiterated the aspect of distributed simulation that is often forgotten in today's rapid pace of distributed simulation development: distributed simulation is not something that can be learned entirely from a book. The most effective way to gain this knowledge and maintain a usable level of expertise is to participate in not only the development of the technology, but in the use of it as well. These tests provided valuable experience in all M&S areas for ACETEF, and helped ACETEF maintain its role as a recognized leader in the use of M&S for T&E.

DTIC

Distributed Interactive Simulation; Flight Simulation; Combat

19990116083 Department of Defense, Office of Inspector General, Arlington, VA USA

Year 2000 Status of the AN/ARC-220 Nap-of-the-Earth Aircraft Communication System

Gimble, Thomas F., Department of Defense, USA; Brannin, Patricia A., Department of Defense, USA; Ugone, Mary L., Department of Defense, USA; Truex, Kathryn M., Department of Defense, USA; Bobbio, Jaime A., Department of Defense, USA; May 14, 1999; 17p; In English

Contract(s)/Grant(s): Proj. 9AS-0090.02

Report No.(s): AD-A366813; RN-99-158; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

The National Defense Authorization Act for FY 1999 requires the Inspector General, DoD, to selectively audit information technology and national security systems certified as Y2K compliant to evaluate the ability of systems to successfully operate during the actual Y2K, including the ability of the systems to access and transmit information from point of origin to point of termination. This is one in a series of reports addressing that requirement. In addition, this is also one in a larger series of reports being issued by the Inspector General, DoD, in accordance with an informal partnership with the Chief Information Officer, DoD, to monitor DoD efforts to address the year 2000 computing challenge. The overall audit objective was to evaluate the ability of the AN/ARC-220 Nap-of-the-Earth Aircraft Communications System to operate successfully in the year 2000, including the

system's ability to access and transmit information from point of origin to point of termination. Additionally, the audit determined the adequacy of the contingency plan and the accuracy of the status reports.
DTIC
Congressional Reports; Global Positioning System; Nap-Of-The-Earth Navigation; Aircraft Communication

19990111577 NASA Langley Research Center, Hampton, VA USA
Multidisciplinary Optimization Branch Experience Using iSIGHT Software
Padula, S. L., NASA Langley Research Center, USA; Korte, J. J., NASA Langley Research Center, USA; Dunn, H. J., NASA Langley Research Center, USA; Salas, A. O., NASA Langley Research Center, USA; 1999; 16p; In English; iSIGHT Users, 4-6 Oct. 1999, Chapel Hill, NC, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Multidisciplinary Optimization (MDO) Branch at NASA Langley Research Center is investigating frameworks for supporting multidisciplinary analysis and optimization research. An optimization framework call improve the design process while reducing time and costs. A framework provides software and system services to integrate computational tasks and allows the researcher to concentrate more on the application and less on the programming details. A framework also provides a common working environment and a full range of optimization tools, and so increases the productivity of multidisciplinary research teams. Finally, a framework enables staff members to develop applications for use by disciplinary experts in other organizations. Since the release of version 4.0, the MDO Branch has gained experience with the iSIGHT framework developed by Engineous Software, Inc. This paper describes experiences with four aerospace applications: (1) reusable launch vehicle sizing, (2) aerospike nozzle design, (3) low-noise rotorcraft trajectories, and (4) acoustic liner design. All applications have been successfully tested using the iSIGHT framework, except for the aerospike nozzle problem, which is in progress. Brief overviews of each problem are provided. The problem descriptions include the number and type of disciplinary codes, as well as all estimate of the multidisciplinary analysis execution time. In addition, the optimization methods, objective functions, design variables, and design constraints are described for each problem. Discussions on the experience gained and lessons learned are provided for each problem. These discussions include the advantages and disadvantages of using the iSIGHT framework for each case as well as the ease of use of various advanced features. Potential areas of improvement are identified.
Author
Multidisciplinary Research; Research Management; Multidisciplinary Design Optimization; Aircraft Design; Design Analysis

19990117191 Defence Science and Technology Organisation, Melbourne Australia
Comparison and Analysis of Strain Gauge Balance Calibration Matrix Mathematical Models
Leung, Sunny Y., Defence Science and Technology Organisation, Australia; Link, Yoel Y., Defence Science and Technology Organisation, Australia; Aug. 1999; 97p; In English
Report No.(s): AD-A369162; DSTO-TR-0857; DODA-AR-011-051; No Copyright; Avail: CASI; A02, Microfiche; A05, Hardcopy

The construction, comparison and analysis of three distinct strain gauge balance calibration matrix models with various orders of the calibration equations was conducted. The aims of the investigation were to identify the accuracy of the three different calibration matrix models and to analyse their behaviour with different data optimisation techniques. A computer program written in the C and X/Motif programming language has been developed to analyse the matrix models. Two different least squares methods and four optimisation techniques have been implemented within the software. The accuracy of each calibration model is evaluated using two statistical estimation methods. It was found that all three balance calibration models had similar behavior in terms of accuracy. The accuracy of the equation in estimating the loads experienced by the balance increases as the order of the calibration equation increases.
DTIC
Strain Gages; Wind Tunnels; Estimating; Strain Gage Balances

19990114345 NASA Marshall Space Flight Center, Huntsville, AL USA
Principles for Payload Operation Integration on the ISS
Belyaev, M. Y, RSC-Energia, Russia; Rulev, D. N., RSC-Energia, Russia; Stazhkov, V. M., RSC-Energia, Russia; Melton, T., NASA Marshall Space Flight Center, USA; 1999; 5p; In English; Tsiolkovski, 14-17 Sep. 1999, Kaluga, Russia; No Copyright; Avail: Issuing Activity, Hardcopy

Many years of experience in operating manned spacecraft (both Russian and American) as well as in implementing international space projects, including joint Russian-American ones, on the Mir and reusable Space Shuttles, have demonstrated that proper management as well as fine-tuned procedures and technology for flight control, are the most important factors determining the high level of efficiency of space flight and its safety. The plan currently under development for management of

ISS flight control meets the requirements for unification as a basis for coordination and integration of the activities undertaken by various links in the flight control process and by different partners. In addition, it also satisfies the national interests of the countries participating in the project. The national interests of the partners can be satisfied by including a number of multilateral councils and groups with representatives of all the International Partners in the management plan. America's national space agency, NASA, will have the main role in coordinating and integrating this plan. The ISS program uses several national control centers to execute payload operations. Integration of ISS payload operations entails resolving the following issues: safety assurance, excluding the effects that different payload operations have on one another, as well as the impact of onboard systems on payload operations' monitoring utilization of ISS integrated resources and improvements in the effectiveness of station operations by optimizing the research program. This article examines approaches and methods for resolving these issues.
Author

Payload Integration; Management Planning; Flight Control; Coordination

19990115005 Army Command and General Staff Coll., Fort Leavenworth, KS USA

How can the Marine Corps Best Employ the F/A-18D as an Airborne Supporting Arms Coordination Platform in Support of the Marine Air Ground Task Force?

Dillard, Mark V.; Jun. 04, 1999; 198p; In English

Report No.(s): AD-A367816; No Copyright; Avail: CASI; A09, Hardcopy; A03, Microfiche

The future of the Marine Corps resounds in Operational Maneuver from the Sea. This doctrine demands complete mastery of the littoral battle space to project amphibious combat power farther and faster than ever before. Critical to the success of any military operation is the commander's ability to quickly make accurate tactical decisions. Because he cannot be physically present over the entire battlefield, he must have systems in place to give him the broad tactical perspective that he lacks. The F/A-18D provides the MAGTF commander with an unparalleled bird's eye view of the battle space, and the ability to reach out to any echelon of his forces instantly. Perhaps more importantly, the F/A-18D offers the commander international dominance over the enemy in time and space, and the ability to bring combat power to bear on high payoff targets at the critical moment to achieve decisive tactical victory. This thesis addresses the inefficient employment of the F/A-18D as an airborne supporting arms coordinator or SAC(A). The introduction of the F/A-18D to the Fleet was not accompanied by carefully considered doctrine to match SAC(A) mission tasking with the aircraft's capabilities. The recommendations contained herein seek to correct the problems that have resulted.

DTIC

Military Operations; Combat; Flying Platforms

19990116929 Texas A&M Univ., Dept. of Psychology, College Station, TX USA

Application of a Distribution-Based Assessment of Mission Readiness Systems for the Evaluation of Technical Training *Interim Report, May - Aug. 1995*

Woehr, David J.; Miller, Michael J.; Bennett, Winston, Jr.; Dec. 1998; 40p; In English

Contract(s)/Grant(s): Proj-1123

Report No.(s): AD-A368461; AFRL-HE-BR-TR-1998-0044; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The present study summarizes research focusing on ways to improve the usefulness of organizational level measures of unit readiness/effectiveness through the evaluation of numerous aircraft maintenance related measures of performance. In addition, a measurement approach using unit level outcome measures is presented, which adapts and extends the performance distribution assessment approach proposed by Kane (1986; 1992). It is demonstrated that, while originally used with subjective performance judgements, the system is readily adapted to regularly collected unit level outcomes. An important characteristic of the measurement system presented a focus on the range of performance observed, which considers the fluctuation or variability in performance as well as the level of performance. In addition, the system incorporates a relativistic scaling of performance information. That is, performance is expressed as a ratio of measured performance to some

DTIC

Aircraft Maintenance; Data Processing; Training Evaluation; Distributed Processing

16
PHYSICS

Includes physics (general); acoustics; atomic and molecular physics; nuclear and high-energy; optics; plasma physics; solid-state physics; and thermodynamics and statistical physics.

19990110628 NASA Lewis Research Center, Cleveland, OH USA

Computation of Supersonic Jet Mixing Noise Using PARC Code With a kappa-epsilon Turbulence Model

Khavaran, A., Sverdrup Technology, Inc., USA; Kim, C. M., NASA Lewis Research Center, USA; First NASA/Industry High Speed Research Program Nozzle Symposium; September 1999, pp. 23-1 - 23-19; In English; See also 19990110605; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

A number of modifications have been proposed in order to improve the jet noise prediction capabilities of the MGB code. This code which was developed at General Electric, employees the concept of acoustic analogy for the prediction of turbulent mixing noise. The source convection and also refraction of sound due to the shrouding effect of the mean flow are accounted for by incorporating the high frequency solution to Lilley's equation for cylindrical jets (Balsa and Mani). The broadband shock-associated noise is estimated using Harper-Bourne and Fisher's shock noise theory. The proposed modifications are aimed at improving the aerodynamic predictions (source/spectrum computations) and allowing for the non- axisymmetric effects in the jet plume and nozzle geometry (sound/flow interaction). In addition, recent advances in shock noise prediction as proposed by Tam can be employed to predict the shock-associated noise as an addition to the jet mixing noise when the flow is not perfectly expanded. Here we concentrate on the aerodynamic predictions using the PARC code with a k-E turbulence model and the ensuing turbulent mixing noise. The geometry under consideration is an axisymmetric convergent-divergent nozzle at its design operating conditions. Aerodynamic and acoustic computations are compared with data as well as predictions due to the original MGB model using Reichardt's aerodynamic theory.

Author

Supersonic Jet Flow; Aerodynamic Noise; Computation; Jet Aircraft Noise; K-Epsilon Turbulence Model; Noise Prediction; Turbulence Models

19990110629 Pennsylvania State Univ., University Park, PA USA

Noise from Supersonic Non-Circular Jets

Morris, Philip J., Pennsylvania State Univ., USA; McLaughlin, Dennis K., Pennsylvania State Univ., USA; First NASA/Industry High Speed Research Program Nozzle Symposium; September 1999, pp. 24-1 - 24-24, In English; See also 19990110605; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

The three main sources of noise in supersonic jets are jet mixing noise, broadband shock-associated noise, and screech. Each of these noise sources may be associated with the large-scale structures in the jet mixing layer. These large-scale structures are also responsible for the gross mixing of the jet. As is discussed below, these structures have a high axial coherence and are both temporally and spatially nearly periodic. In circular jets they may be axisymmetric or helical in nature with the latter form dominating at high jet exit Mach numbers. When the structures convect downstream supersonically with respect to the ambient speed of sound they radiate intense noise, predominantly in the downstream arc. This noise mechanism is called jet mixing or eddy Mach wave noise. If the jet is operating off-design a quasi-periodic shock-cell structure is formed in the jet plume. The interaction between the downstream-travelling large-scale turbulent structures in the jet shear layer and the shock-cell structure results in broadband shock-associated noise. This noise source radiates predominantly in the upstream arc with a peak frequency that depends on the shock cell spacing, the convection velocity of the large-scale turbulent structures, and the angle to the jet downstream axis. When this interaction noise radiates directly upstream it can trigger the phase-locked shedding of large-scale vortex structures from the jet lip. This results in jet screech. This is an intense, tonal noise radiation with a frequency that also depends on the shock cell spacing and the convection velocity of the large structures.

Author

Aerodynamic Noise; Air Jets; Jet Mixing Flow; Noise (Sound); Noise Generators; Screech Tones; Shock Waves; Sound Waves

19990110630 NASA Lewis Research Center, Cleveland, OH USA

Large Eddy Simulation in the Computation of Jet Noise

Mankbadi, R. R., NASA Lewis Research Center, USA; Goldstein, M. E., NASA Lewis Research Center, USA; Povinelli, L. A., NASA Lewis Research Center, USA; Hayder, M. E., NASA Lewis Research Center, USA; Turkel, E., NASA Lewis Research Center, USA; First NASA/Industry High Speed Research Program Nozzle Symposium; September 1999, pp. 25-1 - 25-7; In English; See also 19990110605; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche

Noise can be predicted by solving Full (time-dependent) Compressible Navier-Stokes Equation (FCNSE) with computational domain. The fluctuating near field of the jet produces propagating pressure waves that produce far-field sound. The fluctuating flow field as a function of time is needed in order to calculate sound from first principles. Noise can be predicted by solving the full, time-dependent, compressible Navier-Stokes equations with the computational domain extended to far field - but this is not feasible as indicated above. At high Reynolds number of technological interest turbulence has large range of scales. Direct numerical simulations (DNS) can not capture the small scales of turbulence. The large scales are more efficient than the small scales in radiating sound. The emphasize is thus on calculating sound radiated by large scales.

Author

Noise Prediction; Time Dependence; Navier-Stokes Equation; Jet Aircraft Noise

19990110632 NASA Langley Research Center, Hampton, VA USA

Prediction, Measurement, and Suppression of High Temperature Supersonic Jet Noise

Seiner, John M., NASA Langley Research Center, USA; Bhat, T. R. S., NASA Langley Research Center, USA; Jansen, Bernard J., Lockheed Engineering and Sciences Co., USA; First NASA/Industry High Speed Research Program Nozzle Symposium; September 1999, pp. 27-1 - 27-34; In English; See also 19990110605; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

The photograph in figure 1 displays a water cooled round convergent-divergent supersonic nozzle operating slightly overexpanded near 2460 F. The nozzle is designed to produce shock free flow near this temperature at Mach 2. The exit diameter of this nozzle is 1.5 inches. This nozzle is used in the present study to establish properties of the sound field associated with high temperature supersonic jets operating fully pressure balanced (i.e. shock free) and to evaluate capability of the compressible Rayleigh model to account for principle physical features of the observed sound emission. The experiment is conducted statically (i.e. Mjsub 0) = 0.) in the NASA/LaRC Jet Noise Laboratory. Both aerodynamic and acoustic measurements are obtained in this study along with numerical plume simulation and theoretical prediction of jet noise. Detailed results from this study are reported previously by Seiner, Ponton, Jansen, and Lagen.

Author

Acoustic Measurement; Temperature Measurement; Supersonic Jet Flow; Jet Aircraft Noise; Noise Prediction (Aircraft); Acoustic Emission

19990110633 Lockheed Aeronautical Systems Co., Marietta, GA USA

Prediction of Broadband Shock Noise from Rectangular Nozzles

Reddy, N.N., Lockheed Aeronautical Systems Co., USA; Tam, Christopher K. W., Florida State Univ., USA; First NASA/Industry High Speed Research Program Nozzle Symposium; September 1999, pp. 28-1 - 28-16; In English; See also 19990110605; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

The author describes the development of a semi-empirical broadband shock associated noise prediction program, for supersonic rectangular jets and broadband shock associated noise generation mechanism, by using the broadband, shock associated noise prediction formula, for circular jets, as a starting point, the author can make necessary changes to incorporate new physics of the shock cells and flow turbulence pertinent to supersonic rectangular jets.

Derived from text

Aerodynamic Noise; Noise Prediction; Shock Waves; Broadband

19990110635 NASA Langley Research Center, Hampton, VA USA

Comparisons of Shock Noise Predictions with Flight Data

Norum, T. D., NASA Langley Research Center, USA; Golub, R. A., NASA Langley Research Center, USA; Willshire, W. L., NASA Langley Research Center, USA; First NASA/Industry High Speed Research Program Nozzle Symposium; September 1999, pp. 30-1 - 30-13; In English; See also 19990110605; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

A flight test was performed at NASA Dryden Research Center in November 1991 utilizing both F18 and F16 aircraft. These flights were designed to provide (1) acoustic data that could be extrapolated to that of an HSCT at various points of its climb-to-cruise operation and (2) a data base for noise from a supersonic jet exhausting from an aircraft moving at high subsonic speeds. This presentation utilizes data obtained from these flyovers to evaluate predictions of broadband shock noise from supersonic jets in flight. The F18 is particularly suitable for flyovers of shock noise since it can be flown with one engine at flight idle. The second engine can then be operated at a pressure high enough to produce a supersonic nozzle exhaust and still maintain an unaccelerated, level flyover.

Author

Shock Waves; Noise Prediction; Flight Tests; Data Bases; Supersonic Nozzles; Aerodynamic Noise

19990110642 NASA Ames Research Center, Moffett Field, CA USA

Determination of Jet Noise Radiation Patterns and Source Locations using 2-Dimensional Intensity Measurements

Jaeger, S. M., NASA Ames Research Center, USA; Allen, C. S., NASA Ames Research Center, USA; First NASA/Industry High Speed Research Program Nozzle Symposium; September 1999, pp. 37-1 - 37-23; In English; See also 19990110605; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

Contents include the following: (1) Outline Jet Noise extrapolation to far field. (2) Two dimensional sound intensity. (3) Anechoic chamber cold jet test. (4) Results: Intensity levels, Vector maps, Source location centroids, Directivity, and (5) Conclusions.

Derived from text

Antenna Radiation Patterns; Jet Aircraft Noise; Sound Intensity; Sound Waves; Two Dimensional Models

19990110643 NASA Ames Research Center, Moffett Field, CA USA

Determination of Jet Noise Radiation Source Locations using a Dual Sideline Cross-Correlation/Spectrum Technique

Allen, C. S., NASA Ames Research Center, USA; Jaeger, S. M., NASA Ames Research Center, USA; First NASA/Industry High Speed Research Program Nozzle Symposium; September 1999, pp. 38-1 - 38-26; In English; See also 19990110605; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

The goal of our efforts is to extrapolate nearfield jet noise measurements to the geometric far field where the jet noise sources appear to radiate from a single point. to accomplish this, information about the location of noise sources in the jet plume, the radiation patterns of the noise sources and the sound pressure level distribution of the radiated field must be obtained. Since source locations and radiation patterns can not be found with simple single microphone measurements, a more complicated method must be used.

Author

Noise Measurement; Extrapolation; Radiation Sources; Jet Aircraft Noise; Antenna Radiation Patterns

19990111539 Virginia Polytechn., Inst. and State Univ., Mechanical Engineering Dept., Blacksburg, VA USA

Active Control of Inlet Noise on the JT15D Turbofan Engine *Final Report, Nov. 1997 - Dec. 1998*

Smith, Jerome P., Virginia Polytechnic Inst. and State Univ., USA; Hutcheson, Florence V., Virginia Polytechnic Inst. and State Univ., USA; Burdisso, Ricardo A., Virginia Polytechnic Inst. and State Univ., USA; Fuller, Chris R., Virginia Polytechnic Inst. and State Univ., USA; January 1999; 58p; In English; Original contains color illustrations

Contracts(s)/Grants(s): NAG1-2001; VPI-ENGR-98-166; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report presents the key results obtained by the Vibration and Acoustics Laboratories at Virginia Tech over the year from November 1997 to December 1998 on the Active Noise Control of Turbofan Engines research project funded by NASA Langley Research Center. The concept of implementing active noise control techniques with fuselage-mounted error sensors is investigated both analytically and experimentally. The analytical part of the project involves the continued development of an advanced modeling technique to provide prediction and design guidelines for application of active noise control techniques to large, realistic high bypass engines of the type on which active control methods are expected to be applied. Results from the advanced analytical model are presented that show the effectiveness of the control strategies, and the analytical results presented for fuselage error sensors show good agreement with the experimentally observed results and provide additional insight into the control phenomena. Additional analytical results are presented for active noise control used in conjunction with a wavenumber sensing technique. The experimental work is carried out on a running JT15D turbofan jet engine in a test stand at Virginia Tech. The control strategy used in these tests was the feedforward Filtered-X LMS algorithm. The control inputs were supplied by single and multiple circumferential arrays of acoustic sources equipped with neodymium iron cobalt magnets mounted upstream of the fan. The reference signal was obtained from an inlet mounted eddy current probe. The error signals were obtained from a number of pressure transducers flush-mounted in a simulated fuselage section mounted in the engine test cell. The active control methods are investigated when implemented with the control sources embedded within the acoustically absorptive material on a passively-lined inlet. The experimental results show that the combination of active control techniques with fuselage-mounted error sensors and passive control techniques is an effective means of reducing radiated noise from turbofan engines. Strategic selection of the location of the error transducers is shown to be effective for reducing the radiation towards particular directions in the farfield. An analytical model is used to predict the behavior of the control system and to guide the experimental design configurations, and the analytical results presented show good agreement with the experimentally observed results.

Author

Absorbers (Materials); Acoustics; Active Control; Engine Design; Noise Reduction; Turbofan Engines; Aerodynamic Noise; Intake Systems

19990115887 NASA Langley Research Center, Hampton, VA USA

TiltRotor Aeroacoustic Code (TRAC) Prediction Assessment and Initial Comparisons with Tram Test Data

Burley, Casey L., NASA Langley Research Center, USA; Brooks, Thomas F., NASA Langley Research Center, USA; Charles, Bruce D., Boeing Co., USA; McCluer, Megan, NASA Ames Research Center, USA; 1999; 20p; In English; 25th; European Rotorcraft Forum, 14-16 Sep. 1999, Rome, Italy; No Copyright; Avail: Issuing Activity, Hardcopy

A prediction sensitivity assessment to inputs and blade modeling is presented for the TiltRotor Aeroacoustic Code (TRAC). For this study, the non-CFD prediction system option in TRAC is used. Here, the comprehensive rotorcraft code, CAMRAD.Mod1, coupled with the high-resolution sectional loads code HIRES, predicts unsteady blade loads to be used in the noise prediction code WOPWOP. The sensitivity of the predicted blade motions, blade airloads, wake geometry, and acoustics is examined with respect to rotor rpm, blade twist and chord and to blade dynamic modeling. to accomplish this assessment, an interim input-deck for the TiltRotor Aeroacoustic Model (TRAM) test model and an input-deck for a reference test model are utilized in both rigid and elastic modes. Both of these test models are regarded as near scale model of the V-22 proprotor (tiltrotor). With basic TRAC sensitivities established, initial TRAC predictions are compared to results of an extensive test of an isolated model proprotor. The test was that of the TRAM conducted in the Duits-Nederlandse Windtunnel (DNW). Predictions are compared to measured noise for the proprotor operating over an extensive range of conditions. The variation of predictions demonstrates the great care that must be taken in defining the blade motion. However, even with this variability, the predictions using the different blade modeling successfully capture (bracket) the levels and trends of the noise for conditions ranging from descent to ascent.

Author

Aeroacoustics; Prediction Analysis Techniques; Tilt Rotor Aircraft; Noise Prediction (Aircraft); Aircraft Noise; Interactional Aerodynamics; Blade Vortex Interaction

19990116228 Russian Academy of Natural Sciences, Moscow, Russia

Perspectives of MHD and Plasma Technologies in Aerospace Applications

Jan. 1999; 168p; In English

Contract(s)/Grant(s): F61775-99-W-E070

Report No.(s): AD-A366740; EOARD-CSP-99-5070; No Copyright; Avail: CASI; A02, Microfiche; A08, Hardcopy

The Final Proceedings for Perspectives of MHD and Plasma Technologies in Aerospace Applications, 24 March 1999 - 25 March 1999. This is an interdisciplinary conference. Topics include MHD Super- and Hypersonic Flow Control; Plasma Aerodynamics (Drag and Flow/Flight Control); Shock Wave Structure and Propagation in Gas-Plasma Mixture; On-board MHD Systems and Plasma Generators; MHD/EM Accelerators and Thrusters, etc...

DTIC

Magnetohydrodynamic Flow; Magnetohydrodynamics; Shock Wave Propagation; Plasma Generators; Hypersonic Flow; Conferences; Aerodynamics

17
SOCIAL SCIENCES

Includes social sciences (general); administration and management; documentation and information science; economics and cost analysis; law, political science, and space policy; and urban technology and transportation.

19990115448 Department of Defense, Office of the Inspector General, Arlington, VA USA

Allegations to the DoD Hotline on Contract Maintenance for the C-20 Aircraft

Feb. 04, 1999; 52p; In English

Contract(s)/Grant(s): Proj. 8CK-8005

Report No.(s): AD-A367603; IG/DOD-99-077; No Copyright; Avail: CASI; A01, Microfiche; A04, Hardcopy

The audit objectives were to evaluate the C-20 contractor logistics support contract and to evaluate Government contract administration for the contract. We also reviewed the specific allegations to the DoD Hotline. We did not review the management control program because the scope of the audit was limited to the allegations and one contract.

DTIC

Transport Aircraft; Aircraft Maintenance; Contract Management; Logistics

Subject Term Index

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Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
NASA/SP—1999-7037/SUPP-410		

4. Title and Subtitle	5. Report Date
Aeronautical Engineering A Continuing Bibliography (Supplement 410)	December 1999
	6. Performing Organization Code

7. Author(s)	8. Performing Organization Report No.
	10. Work Unit No.
9. Performing Organization Name and Address	
NASA Scientific and Technical Information Program Office	11. Contract or Grant No.

12. Sponsoring Agency Name and Address	13. Type of Report and Period Covered
National Aeronautics and Space Administration Langley Research Center Hampton, VA 23681	Special Publication
	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

This report lists reports, articles and other documents recently announced in the NASA STI Database.

17. Key Words (Suggested by Author(s))	18. Distribution Statement
Aeronautical Engineering Aeronautics Bibliographies	Unclassified – Unlimited Subject Category – 01

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	110	A06/HC

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